ELECTRICAL WEST

Gabriel Moulin Photo

Light begins a new career of public service. A thousand sodium vapor lighting units speed traffic safely along the 13 miles of roadway of the San Francisco-Oakland Bay Bridge—a lighting installation as spectacular as the structure itself.

DECEMBER 1936

McGraw-Hill Co. of Calif. Price 25c Per Copy

Holiday Greetings to the Electrical Industry

The 3600 men and women who are the Southern California Edison Company extend their best wishes for a Joyous Christmas and a New Year blessed with health, happiness and abundant prosperity.

Above all they wish to express their thanks for the earnest cooperation of every electrical dealer. This united effort is chiefly responsible for the record-breaking sales of 1936 and holds forth promise of an even better year in 1937.

SOUTHERN CALIFORNIA EDISON COMPANY LTD.

12-36

CALIFORNIA'S *Electrical Age* HAS JUST BEGUN!

ELECTRICAL WEST (with which is consolidated The Journal of Electricity), December, 1936, Vol. 77, No. 6. Published monthly by the McGraw-Hill Company of California, 883 Mission St., San Francisco, Calif. Entered as second class matter at the post office at San Francisco under the Act of March 3, 1879. Additional entry as second class matter at the post office at Los Angeles. Printed in U. S. A. Subscription rate in U. S. and U. S. possessions, and Canada, $2 per year; all other countries $3 gold (thirteen shilling). Single copy, 25c.

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ELECTRICAL WEST

With which are consolidated the "Electrical Journal," the "Journal of Electricity, Power and Gas," and the "Journal of Electricity."

ESTABLISHED 1887

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▼

• R. M. E. A. ENGINEERING REPORTS. Appearing in this issue are the first group of engineering reports of the Rocky Mountain Electrical Assn. The remainder will be published next month. Of particular interest is a distribution study presenting a complete analysis of system loading together with summer and winter load curves. The reports begin and are indexed on page 38.

•

• NUMBER ONE example of fine highway illumination by sodium vapor lamps is the installation on the San Francisco-Oakland Bay Bridge, which went into service last month. It comprises 1,000 units consuming energy estimated to cost $22,000 per year. Circuits, statistics and contruction details are presented in a pictorial section beginning on page 53.

•

• ELECTRICAL WEST'S editors are grateful for the many expressions commenting favorably on the pictorial insert featuring Boulder Dam power which was a part of the October issue. In addition to the 6,000 copies of the magazine containing this insert, there have been distributed in excess of 14,000 reprints of this editorial feature, which in itself is ample testimony to the need for such a presentation.

•

• ONE THOUSAND DEALERS in the eleven western states recently were sent inquiries by ELECTRICAL WEST, asking, "What are your most important sales problems?" Their replies, tabulated and discussed on page 30, form the basis of a series of discussions, the first of which will appear in the next issue.

•

• ENGINEERS! An opporunity to put your ideas before the industry is afforded by prize paper contest announced by the Operating and Economics Section of the Pacific Coast Electrical Assn. Almost every engineer will have encountered one or more of the three vital problems, chosen by the Association, during his experience in the industry. Turn to page 62 for details.

•

• WORLD FAIR time in San Francisco will not catch the electrical industry napping. Careful planning is already under way to assure electricity its deserved prominence in the Golden Gate International Exposition. Charles Huyck, whose first article on the exposition appeared in the August issue, tells of further developments. "A Palace for the Industry" begins on page 21.

•

• SUNLAMPS will sell during the cloudy months ahead. To help dealers sell sunlamps is appropriately the subject of this month's Appliance Sales Guide, page 33.

The completeness and usefulness of Graybar's service of supply results naturally from Graybar's years of experience in meeting utility needs... Operating through conveniently located warehouses, Graybar brings you what you want, when and where you want it... also Graybar cooperates further by constantly promoting the sale of load building electrical products of every description.

Offices in 79 principal cities: Executive offices, Graybar Building, New York

Distributed and guaranteed by GraybaR ELECTRIC COMPANY

GraybaR

Kelvinator cuts the cost of better living

The keynote of the Kelvinator program for 1937 will be—"Kelvinator Cuts the Cost of Better Living".

In a few short weeks you will learn about the program.

It will be welcomed by millions of families throughout America.

It will reach the people in your city, your town, your village.

It will herald a renaissance in the standards of American living.

It will make possible for the man of average income such luxury as has only been dreamed of by the millionaire.

It will present an opportunity to salesmen, specialty dealers, department and furniture stores, public utilities, such as has not been known before.

You will want to know about it.

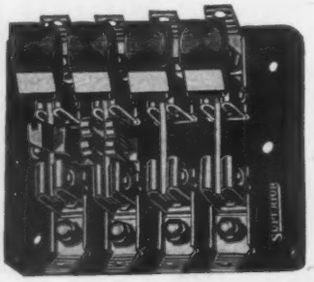
You will want to be part of it.

KELVINATOR CORPORATION

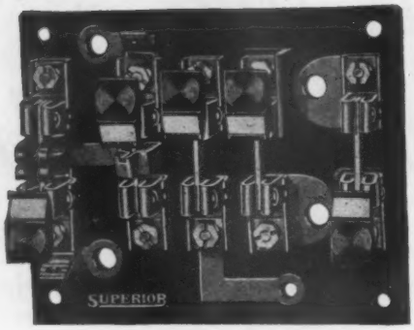
Detroit • Michigan

RELAY TEST SWITCHES

Are your relays *really tested* or just "guessed at."



Put Superior Test Switches on your relays and make that testing job a safe, sure, accurate operation.



Switchboards too crowded for front mounted Superior Relay and Instrument test switches can use our stud mounting types as shown above. These switches mount directly on the back connecting studs of their relays and instruments.

WESTERN REPRESENTATIVES

E. H. BELL	L. A. NOTT	T. S. WOOD
912 East Third Street	1061 Howard Street	220-9th Avenue, N.
LOS ANGELES	SAN FRANCISCO	SEATTLE
Dial Lafayette 8261	Dial Hemlock 4738	Dial Eliott 8204

Superior Switchboard & Devices Co.

Canton, Ohio

*Been at it Since 1920

SUPERIOR

REG. U. S. PAT. OFF.

....Trade Literature

OILOSTATIC TRANSMISSION, a system in which conductors are buried in metal pipe filled with oil maintained under a constant pressure of 200 lb. per sq. in., is described in a booklet of The Okonite Co., 501 Fifth Ave., New York. Claimed for the method are higher dielectric strength, greater insulation stability, high current carrying capacity, absence of voids in the insulation and no practical voltage limits. The booklet, which is illustrated, gives a general description of the method, details of construction, and an outline of existing installations.

●

"THE HOME WORKSHOP" is a booklet for model-makers, amateur mechanics and other homeshop enthusiasts. Published by the South Bend Lathe Works, South Bend, Ind., it illustrates and describes many home workshops owned and being used by prominent persons. It includes illustrations of machining operations; tables of wire-gauges, screw-threads, etc.; a directory of manufacturers of parts and plans for all types of models, and descriptions of a variety of homeshop machines which will plug directly into the light socket.

●

RECTOX copper oxide rectifiers are described in a 12-page booklet (B-2078) announced by Westinghouse Electric & Manufacturing Co. Application data including regulation, power factor, life and aging, continuous and intermittent duty are given.

●

UNIVERSAL FUSE LINKS is the title of Bulletin 218 published by Schweitzer & Conrad, Inc., Chicago. Theory and application of fuse links for distribution cutouts are supplemented with reproductions of time current curves, charts showing the influence of ambient temperatures and preloading, and arcing time.

●

"PROGRESS in Air Conditioning in the Last Quarter Century" is an attractive reprint by Carrier Engineering Corp. of the paper by that title presented this year to the American Society of Heating and Ventilating Engineers by W. H. Carrier.

●

CURRENT CATALOG has been published by BullDog Electric Products Co., Detroit, describing its complete line of controlling and distributing apparatus for electric light and power.

●

WIRED HELP is a dramatically presented booklet by the Westinghouse rural electrification department presenting with pictures the many ways in which electricity benefits the farm and home.

●

IVANHOE commercial and industrial lighting equipment is described in two catalogs, Nos. 888 and 903, published by The Miller Co., Meriden, Conn.

●

UNIT HEATING by Ilg is the title of Catalog No. 125, released by Ilg Electric Ventilating Co., Chicago. Descriptive material, diagrams and pictures of installations and an abundance of performance data are included.

●

COLT NOARK celebrates its 100th anniversary with the issuance of a completely revised catalog. It presents complete details on all Colt-Noark products. Copies are available upon application to Electrical Division, Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn.

●

PLANNING ADEQUATE STREET LIGHTING is an informative bulletin for municipalities published by General Electric Co.

TURNLOX

The Economical Answer to the Problem of Maintaining R. L. M. Efficiency

To your customer, the maintenance of RIGHT LIGHT *efficiency* is just as important as his obtaining a RIGHT LIGHT *installation!* He must be shown WHY and HOW! And it is the duty of every member of the electrical industry to show him!

Not only must he be shown that blackened, inefficient lamps and dirty reflectors can waste from 20% to 80% of their rated R.L.M. efficiency but he should be shown HOW to avoid this loss at the lowest possible maintenance cost.

That is why TURNLOX, Benjamin's patented hood construction, is such an important feature to bring to the attention of every prospective buyer of industrial lighting equipment.

TURNLOX is the best answer to the maintenance problem. Its unique construction permits BOTH the reflector and lamp to be removed as one unit. Thus lamp inspection is simplified, frequent cleaning encouraged, cleaning costs reduced to a minimum. Safety, too, is promoted. The only time the cleaner need spend on the ladder is that required to replace the unit with a cleaned one. Thus the ladder hazard is reduced to a minimum.

If you do not have complete details on TURNLOX or complete data on all of the many Benjamin units which come equipped with this important feature, *Mail Coupon TODAY.*

IT COMES APART!
BOTH Lamp and Reflector are detached as ONE UNIT by a slight upward pressure and a ¼ turn.
BENJAMIN DOME 500
ELECTRICAL TESTING LABORATORIES
R.L.M. stands for certain high standards of illuminating efficiency which are certified by the Electrical Testing Laboratories of New York to be met by all products bearing this label.
TURNLOX FEATURES
3 POINT BAYONET COUPLING
• Positive lock
• Immediate Connection
• No prongs or contacts to locate
• Automatic Polarization
SELF CLEANING CONTACTS
• Contacts are cleaned as the reflector is turned into hood.
SPIRAL COMPRESSION SPRING
• Insures positive electrical connection.
EASY TO WIRE
• Nothing in way or hard to reach.
• No screws to remove.

BENJAMIN ELECTRIC MFG. CO., Dep't BW Des Plaines, Ill.

SEND ME COMPLETE DETAILS ON TURNLOX

Firm Name_____

Name_____

Address_____

City_____ State_____

BENJAMIN

REFLECTORS

YOUNGSTOWN

BUCKEYE CONDUIT

★Conduit buyers who standardize on BUCKEYE Conduit protect themselves from all risk of irregular quality.

YOUNGSTOWN metallurgists and inspectors have perfected an intensive production-control which holds every shipment of conduit rigidly to standard.

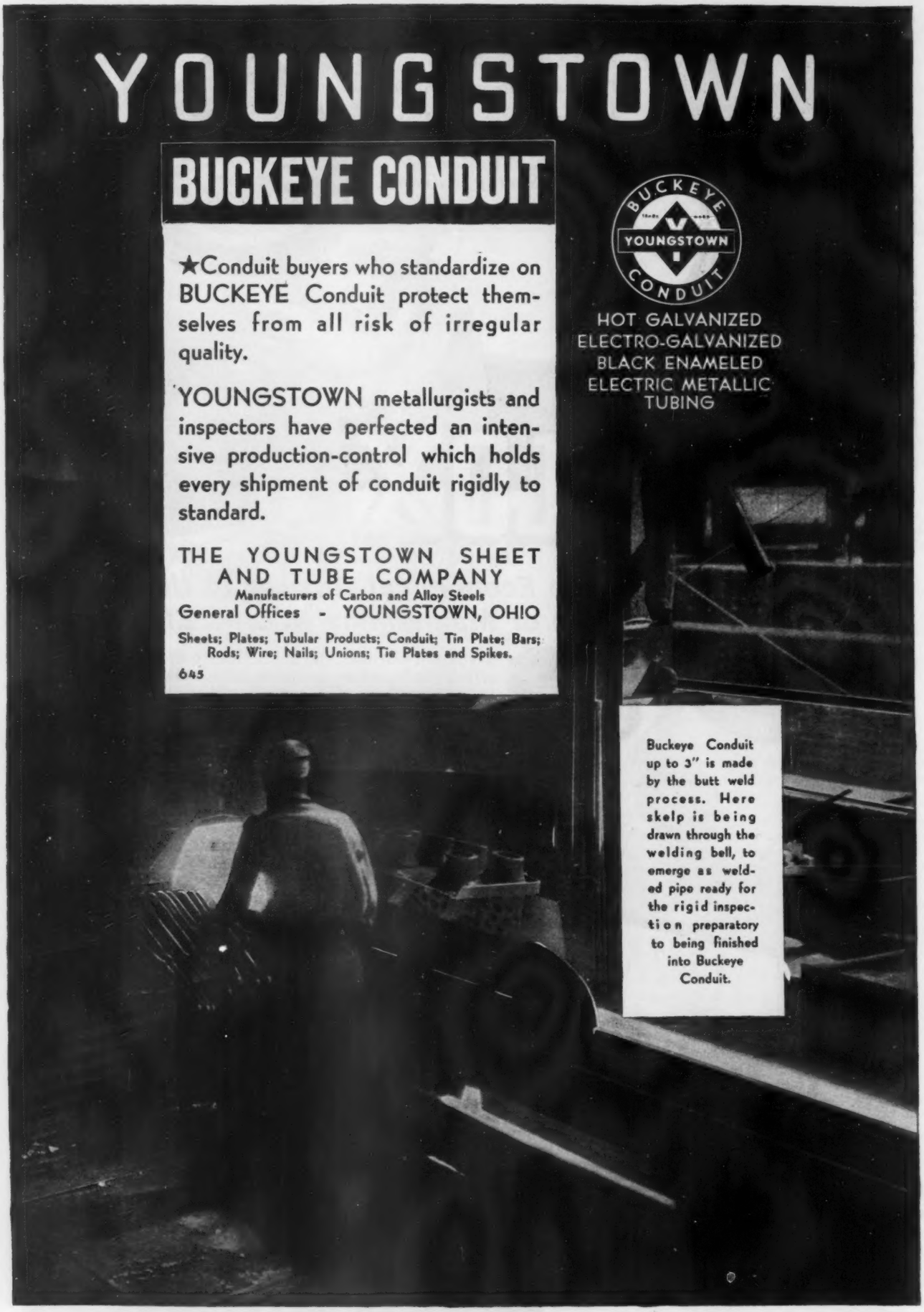
THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon and Alloy Steels
General Offices - YOUNGSTOWN, OHIO

Sheets; Plates; Tubular Products; Conduit; Tin Plate; Bars; Rods; Wire; Nails; Unions; Tie Plates and Spikes.

645

BUCKEYE YOUNGSTOWN CONDUIT

HOT GALVANIZED
ELECTRO-GALVANIZED
BLACK ENAMELED
ELECTRIC METALLIC
TUBING



Buckeye Conduit up to 3" is made by the butt weld process. Here skelp is being drawn through the welding bell, to emerge as welded pipe ready for the rigid inspection preparatory to being finished into Buckeye Conduit.

A MESSAGE TO FRIGIDAIRE DEALERS AND SALESMEN

A DEEP SENSE of appreciation prompts us to address this public message to the Frigidaire Selling Organization:

In 1936, you achieved the greatest sales success in the entire history of the refrigeration industry.

During the first six months, you sold more Frigidaires than during the entire year of 1935, or any other year.

And your rapid pace never slackened. Week after week, month after month, right through the year, you continued to pile up new selling records.

A few short months ago, we were proud that Frigidaire had sold one and one-quarter million more mechanical refrigerators than any other manufacturer. But now, because of your untiring efforts, Frigidaire can point with even greater pride to a margin of leadership of over one and one-half million refrigerators.

We helped you, of course. We gave you the Frigidaire with the Meter-Miser, a product conceived, designed and built with a single unwavering aim—to meet *all five* standards for refrigerator buying. We gave you carefully-prepared "Buy on Proof" selling plans, specially geared to the marketing problems of all three major selling seasons. We gave you the backing of dynamic, sales-compelling advertising.

But to all these ingredients of success you added one that was most important of all . . . one that is the essence of a winning campaign: Your Own Resourceful and Aggressive Activity.

Together, we have fulfilled the promise "You can do better with Frigidaire in 1936."

We are working now to make 1937 a greater year for Frigidaire Selling Men. Soon you will have new and more salable products, *featuring a revolutionary improvement that will be the talk of the industry and instantly capture the imagination of the buying public.* Backing up these amazing products will be a new, forceful sales and advertising program, to help you harvest, once again, an even larger volume of sales and earnings with Frigidaire.

Together, we have fulfilled the promise "You can do better with Frigidaire in 1936." The opportunity and the means are now at hand to fulfill another promise: "You will do *still better* with Frigidaire in 1937."

FRIGIDAIRE DIVISION
General Motors Sales Corporation
Dayton, Ohio

FOR POLE TO METER CONNECTIONS
and
NEW SEQUENCE SERVICE LAYOUTS
HAZARD UBN ENTRANCE CABLE

[U. B. N. means UNARMORED, BARE-NEUTRAL]

UBN CABLE AFFORDS THESE ADVANTAGES

Continuity: The circuit need not be broken from the pole to the meter.

Protection: Full visibility is afforded and construction discourages attempts at current diversion.

Durability: The high quality of the rubber insulation, the moisture proof braids on the conductors, and the flame retarding and weather-proof outer braid assure durability.

Appearance: The one length of the same kind of cable, the ability to paint the cable to match the house, and the easy bending of the cable to contours of the building afford the neatest appearance allowable in service work.

Economy: The simplified construction, with elimination of conduit, and the easy strapping of the cable to the house minimize installation costs.

Send for booklet: "HAZARD SERVICE CABLES"

HAZARD INSULATED WIRE WORKS

Division of The Okonite Company

WORKS: WILKES-BARRE, PA.

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH BUFFALO DETROIT BOSTON
ATLANTA SAN FRANCISCO LOS ANGELES SEATTLE DALLAS WASHINGTON

$100,000 FOR PLANT EQUIPMENT or $14,000 FOR CARRIER-CURRENT CONTROL?

THAT'S the problem that confronted the Idaho Power Company at its Boise, Idaho, substation. Sales of domestic appliances had pushed up the domestic load to new peaks—peaks which represented an investment of $100,000 in plant equipment for the domestic water-heater load alone.

General Electric engineers gave the Idaho Power Company the answer to this problem—recommended carrier-current control at a cost of only $14,000. The company liked the idea, and now Boise water heaters are being served on a controlled off-peak basis by use of carrier. High-frequency signals are sent out over the power wires, and a relay in the customer's home puts the heater on or off the line at the direction of the sub-station operator.

It is estimated that the supplying of each kilowatt of peak load at a customer's meter requires three or four hundred dollars investment in power equipment. In tests with carrier current at Boise, this demand at peak time was reduced about six-tenths of a kilowatt for each water heater on the system. Think what that can mean to your company!

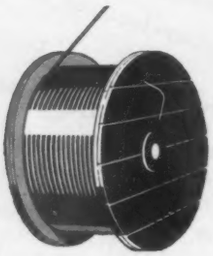
Carrier-current control for off-peak heating allows you to take full advantage of the profitable water heater business that is now available. Let us tell you more about it. General Electric, Schenectady, N. Y.

906-3

GENERAL ELECTRIC

A·C·S·R

A NATURAL ADVANTAGE COMMERCIALLY REALIZED



Nature made Aluminum light. Nature provided Aluminum with high electrical conductance. On those fundamentals rest the real economies commonly associated with A. C. S. R.

Transmission engineers are thoroughly familiar with the savings in erection and upkeep which Aluminum Cable Steel Reinforced achieves by virtue of its better strength-weight ratio. Long spans, low corona loss, protection against flashovers and superior resistance to corrosion cut costs at every turn.

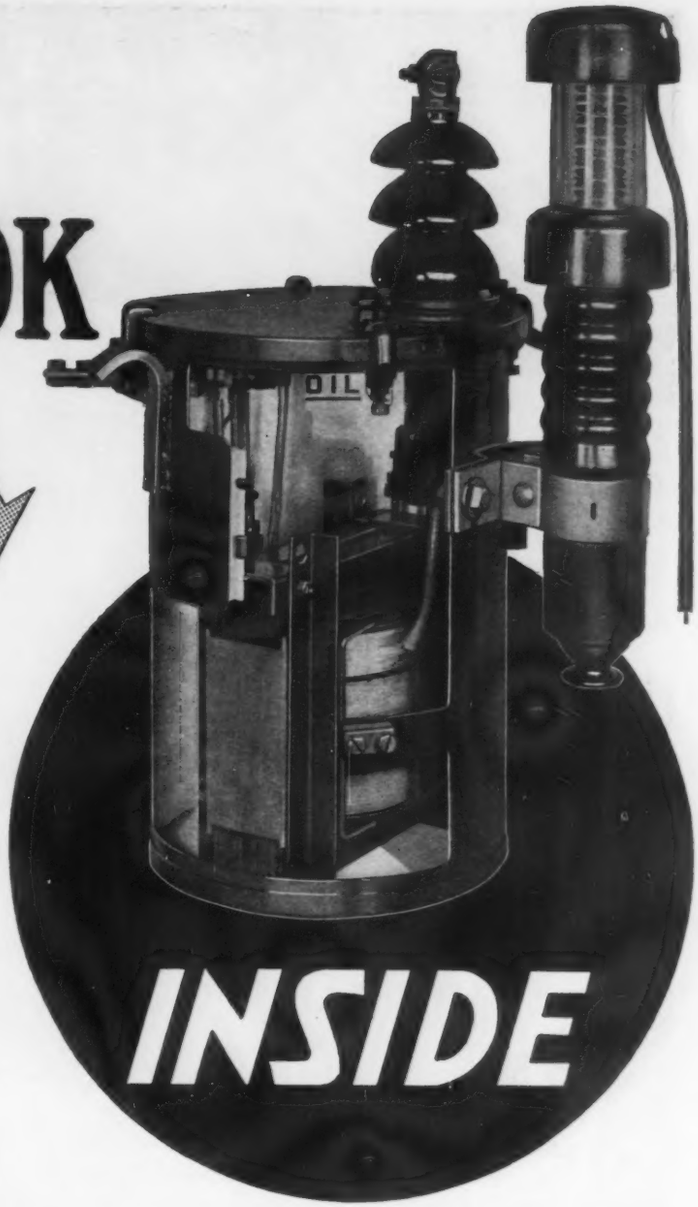
Now A.C.S.R. offers one more advantage:—A.C.S.R. developments, service, and devices for vibration control are making notable savings in maintenance expense.

May we give you the latest facts on the application of Armor Rods and the Stockbridge Damper? Our engineers are always ready to co-operate with you in solving such problems. ALUMINUM COMPANY OF AMERICA, 2132 Gulf Building, Pittsburgh, Pa.

ALCOA
ALUMINUM
REG. U.S. PAT. OFF

ALUMINUM COMPANY OF AMERICA

LET'S LOOK



1½ kva, 6900/11,950 high voltage, 115/230 low voltage, Type HAE High Efficiency Rural Line Transformer.

MOST rural line transformers look the same from the outside —but remember, the most important part of a transformer is beneath the surface. And that is where most transformers differ.

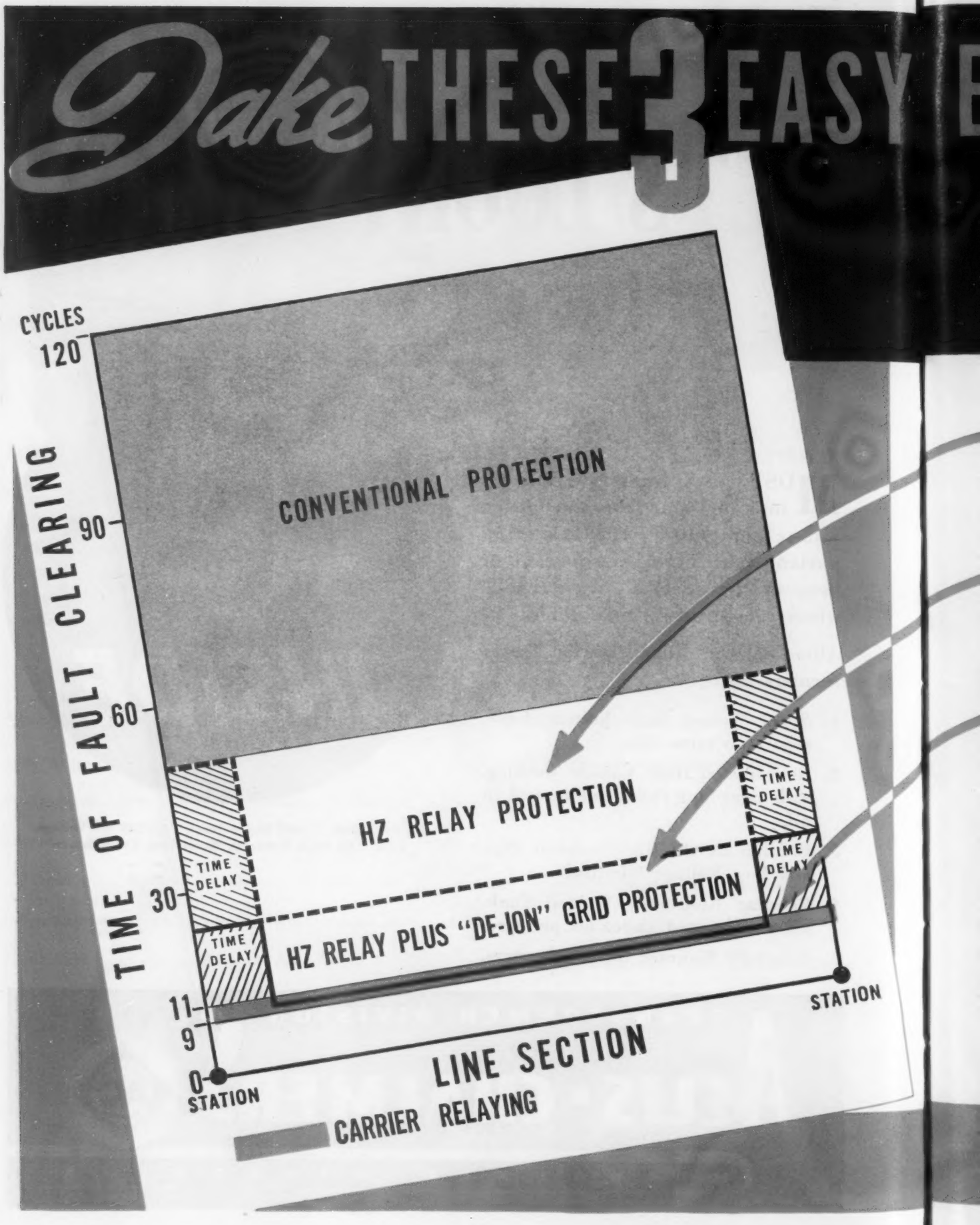
Allis-Chalmers Rural Service Transformers feature:

1. **Spool Wound High Voltage Coils, separately removable.**
2. **Coordinated High Voltage Bushing, with extra long shank submerged in oil.**
3. **Continuous Oil Duct between High and Low Voltage Windings.**
4. **Circular Resistance Welded Tank. All tanks tested under oil pressure.**
5. **Integrally Mounted Surge Diverters.**

TRANSFORMER DIVISION

ALLIS·CHALMERS

MILWAUKEE WISCONSIN


Take THESE 3 EASY
CYCLES
120
90
60
30
11
9
0
TIME OF FAULT CLEARING
CONVENTIONAL PROTECTION
HZ RELAY PROTECTION
HZ RELAY PLUS "DE-ION" GRID PROTECTION
TIME DELAY
TIME DELAY
TIME DELAY
TIME DELAY
STATION
STATION
LINE SECTION
CARRIER RELAYING

ECONOMICAL STEPS *to:* INCREASE LOAD CAPACITY IMPROVE SYSTEM STABILITY DECREASE LINE DISTURBANCES

STEP 1

Replace your present conventional relays with Type HZ High-Speed Relays that eliminate graded time settings and secure fast clearing of severe faults over 80% of each line section.

STEP 2

Install new "De-ion" Grid breakers or modernize your present Westinghouse breakers with "De-ion" Grids to get 8-cycle breaker operation. With Step 1 accomplished this gives 9 to 11-cycle protection over 80% of each section.

STEP 3

Eliminate end-zone time delay with carrier relaying to assure 9 to 11-cycle, straight-line, high-speed protection throughout the whole of every section.

ONLY FROM WESTINGHOUSE CAN YOU GET THE FULL BENEFITS OF CARRIER RELAYING IN THESE THREE EASY SUCCESSIVE STEPS.

● With the Westinghouse system of carrier relaying, built around the proved HZ distance elements, it is not necessary to start from scratch or to do the job all at one time. If you have Westinghouse high-speed distance protection already installed, Step One can be eliminated. And, of course, Step Two can be carried out before Step One if desired.

Many companies are finding it to their advantage from a financial point of view to install HZ relays and "De-ion" Grids a year or two ahead of Carrier Relaying. And they find that this method requires no more actual equipment than if they did the job all at one time.

They get immediately 9 to 11-cycle protection or better over 80% of every line section, and then . . . at a later date . . . eliminate the end-zone time delay to attain the maximum in:

1—Increased load capacity
2—Improved system stability
3—Fewer line disturbances

This Westinghouse system of attaining faster clearing of faults is particularly suitable to load conditions of today where immediate improvement in line capacity and system stability is imperative, but where the cost of installing Carrier Relaying is at present financially impractical. Later as loads increase further, the additional benefits of Westinghouse Carrier Relaying can be obtained.

For detailed information, address Room 5-N, East Pittsburgh, Pa. J 40048

QUALITY WESTINGHOUSE 1886 1936 GOLDEN JUBILEE METERS INSTRUMENTS RELAYS

Westinghouse

VARNISHED CAMBRIC • RUBBER POWER CABLES • BUILDING WIRE • RADIO WIRES • SIGNAL CABLE • FLEXIBLE CORDS • LEAD-ENCASED AND PARKWAY CABLES • ARMORED CABLE

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

From raw material—
—to finished product

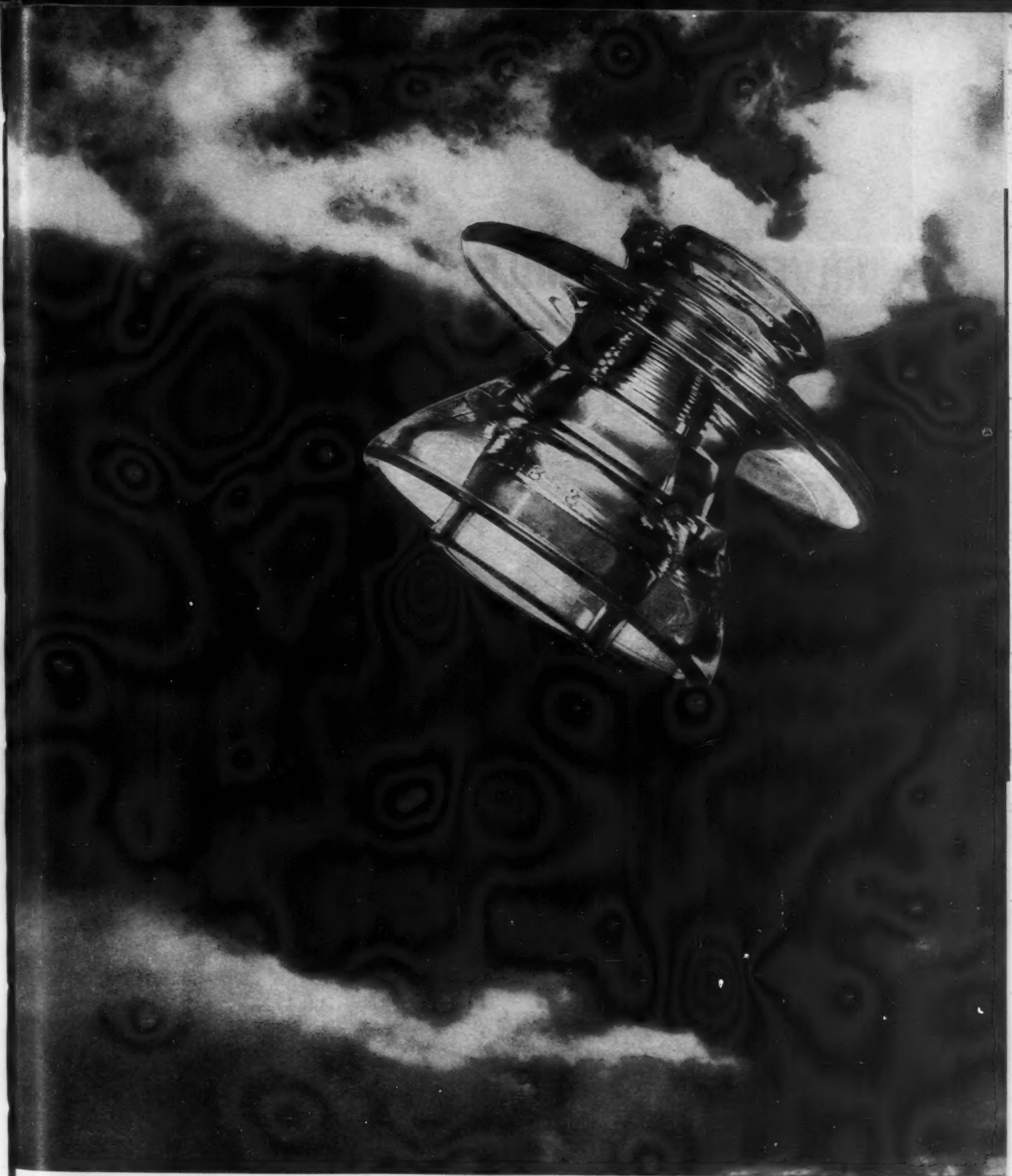
CRESCENT WIRE

IS MADE IN THE CRESCENT PLANT

The battery of more than one thousand braiding machines, shown in the above picture, is used to apply cotton, silk and rayon braids in the manufacture of CRESCENT insulated wires and cables. This is only one of the many operations that go on in this extensive plant, where a complete line assures you of one reliable source of supply.

CRESCENT
INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

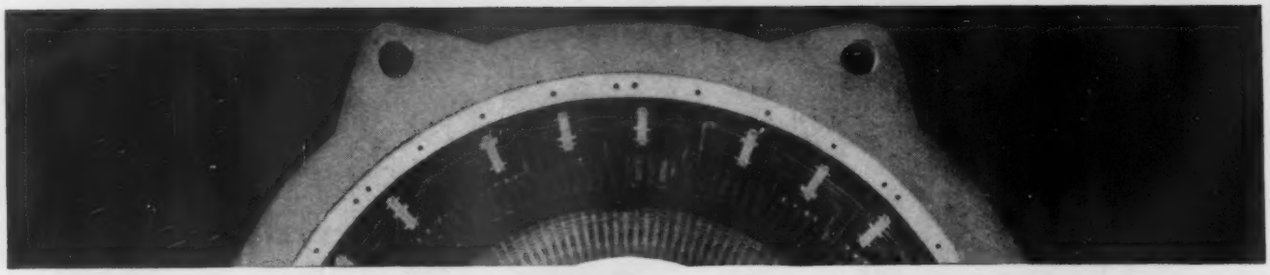
CRESCENT ENDURITE SUPER-AGEING INSULATION • WEATHER-PROOF WIRE



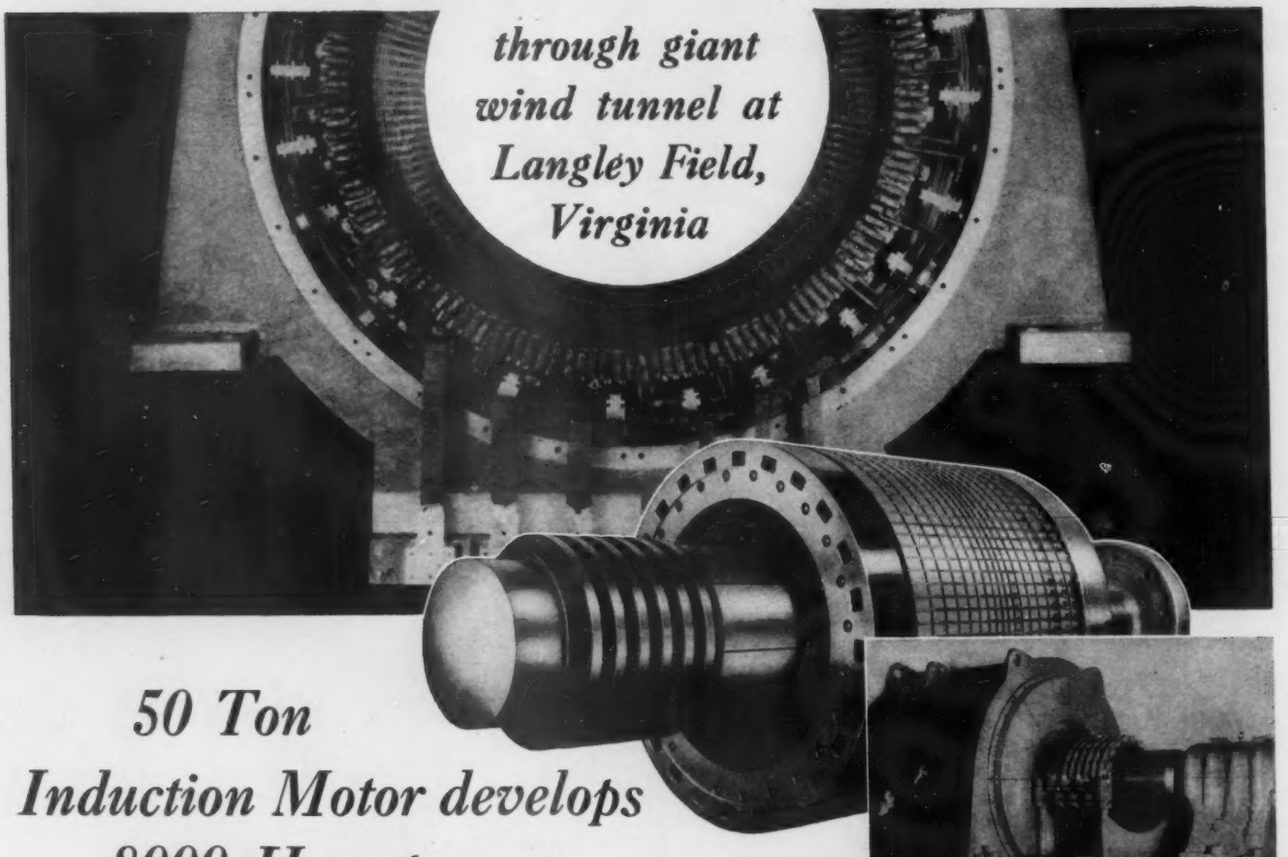
ONE-PIECE CONSTRUCTION...another high spot in

TODAY'S TREND TOWARD PYREX POWER INSULATORS

PYREX is a Trade Mark and indicates manufacture by Corning Glass Works, Corning, N. Y.



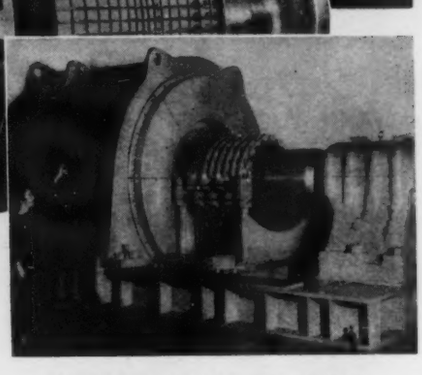
DRIVES A 500 MILE AN HOUR GALE—



50 Ton Induction Motor develops 8000 Horsepower

THIS huge 50-ton motor — the driving power for a new "full speed" wind tunnel used by the National Advisory Committee for Aeronautics to conduct scientific research in aeronautics — was recently installed at its laboratories at Langley Field, Virginia. Solidly coupled to a fan shaft, with an 18 blade fan, this motor, at its maximum, delivers a 500 mile an hour wind at the test chamber.

The Magnet Wire used in its construction was furnished by the American Steel & Wire Company — specialists in the making of Magnet Wire — of every type and grade — and of Electrical Wires and Cables for all uses.



INTERESTING FACTS ABOUT THIS UNUSUAL MOTOR

Made by the Crocker Wheeler Electric Manufacturing Company, Ampere, New Jersey — develops 8000 H.P.— and its base measures 115" wide and 190¼" long.

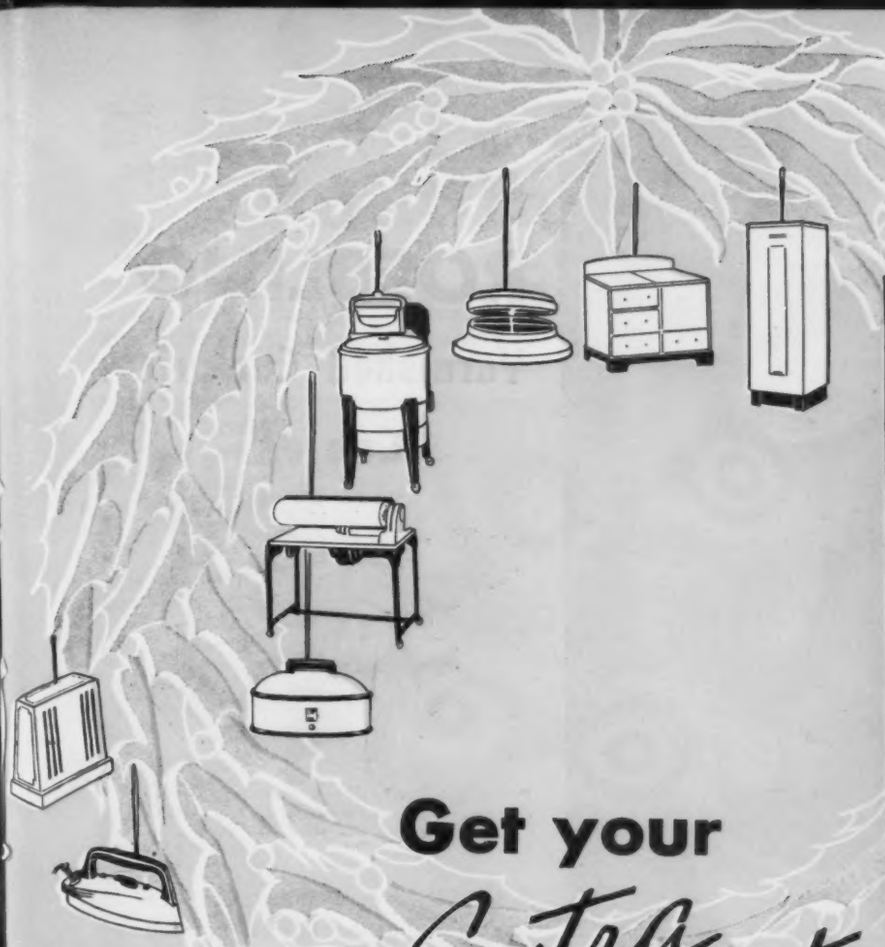
U·S·S MAGNET WIRE

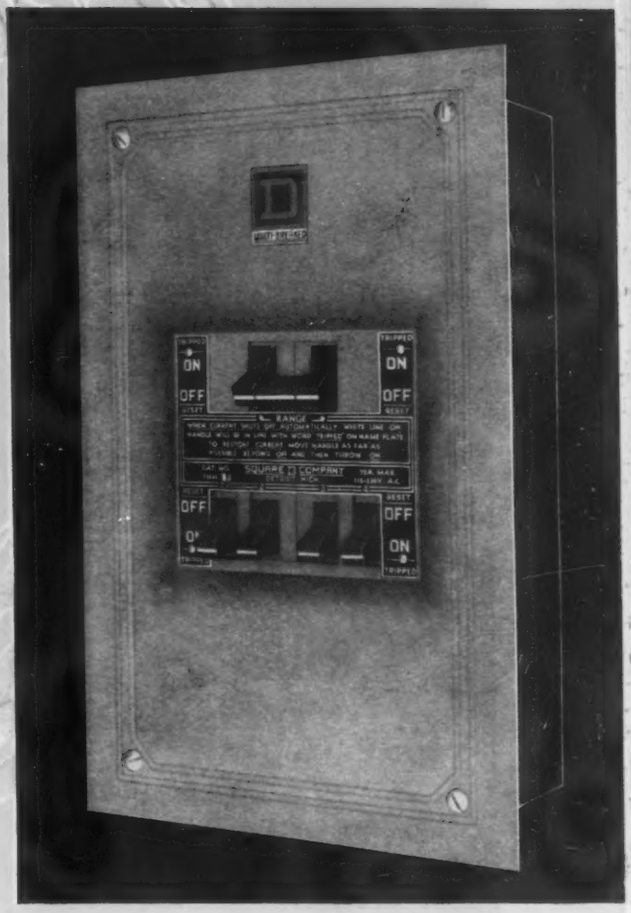
COLUMBIA STEEL COMPANY, *San Francisco*

Pacific Coast Distributors of USS Magnet Wire for American Steel & Wire Company

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL





Get your *Extra Profits* from Christmas Appliance Sales with SQUARE D MULTI-BREAKER

This advertisement appears in TIME—The Weekly Newsmagazine, December, 28th.

Tonight—when the lights go out....
A TRIP TO THE BASEMENT
OR A FLIP OF THE FINGER
MULTI-BREAKER
eliminates the necessity of replacing blown fuses...
SQUARE D COMPANY

■ **Follow up your Christmas appliance sales with an active re-wiring campaign and use the Square D Multi-breakeR as your main sales talking point. Major appliances will require new house wiring—smaller appliances suggest overloaded circuits and blown fuses, especially in inadequately wired homes.**

The Multi-breakeR has more customer-appeal than most of the electrical conveniences which you have been selling. And it brings you a wiring job, as well as a good profit.

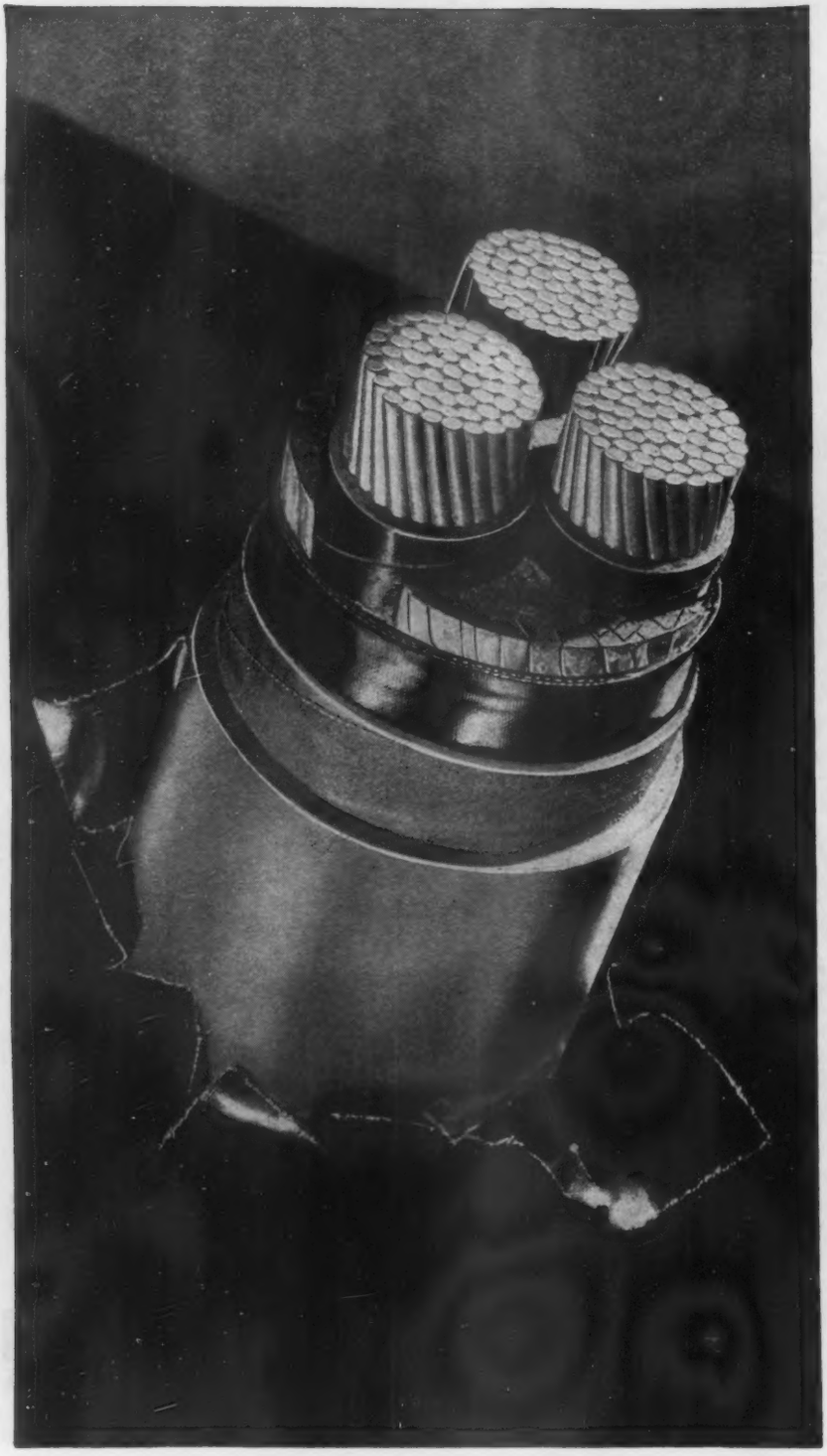
The Multi-breakeR is sure protection against overloaded circuits. It eliminates the cost, inconvenience and fear of changing fuses. The flick of a handle restores the circuit. For installations up to six circuits, it is used as the main service entrance as well as branch circuit protection and switching—you need no meter switch. Your customers will gladly pay the small additional cost. Ask your Square D distributor about the attractive counter display and Multi-breakeR literature. They will help you procure new wiring jobs.

SQUARE D COMPANY

LOS ANGELES - DETROIT - MILWAUKEE

SQUARE D COMPANY CANADA LTD. TORONTO, ONTARIO

CALL IN A SQUARE D MAN



ROEBLING

Varnished Cambric Cables

Power Cable Test Panel with an ultimate capacity of 600,000 volts, one of many factory tests to which Roebling Wire and Cable is subjected.

A wealth of experience goes into the making of this fine cable. From copper to outer covering it is of traditional Roebling high quality ... the product of good materials, careful workmanship, and exacting tests.

Roebling Varnished Cambric Cable is available in single, two, and three-conductor types; for a wide range of voltages; in all commercial sizes.

Braided or leaded. Also with steel, zinc or bronze tape, or round wire steel armor.

We would welcome your inquiry for further information and prices in connection with this type of cable or any of the 60 other types at the left.

JOHN A. ROEBLING'S SONS CO. OF CALIF.
San Francisco - Los Angeles - Seattle - Portland

OVER 60 OTHER TYPES

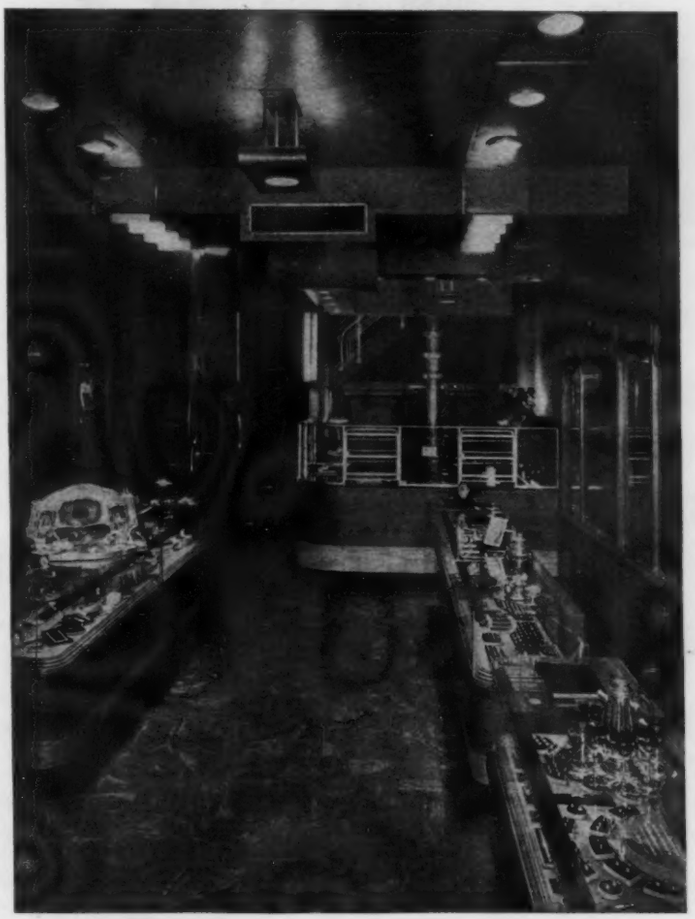
Power Cables: Paper; Cambric; Rubber » Parkway Cable » Tree Wire » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables: Code; Intermediate; 30% and 40% Performance; 35% and 40% Performite; Plain Rubber 60% Sheath Power Cable and 40% or 60% Sheath Flexible Cords » Slow Burning Wires and Cables » Weatherproof Wires and Cables » Submarine Cables » Portable Cords » And a wide variety of other wires and cables.

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

PERMAFLECTOR
Built-In Direct Lighting

Modern illumination for modern stores. Efficient direct lighting from concealed sources. Recessed Permaflectors control the light, delivering high intensity of illumination to the merchandise without any glare and with no feeling of excessive brightness.

Standardized equipment. Concentrating type Permaflectors for high ceilings; extensive Permaflectors for low ceilings. Units may be arranged to create patterns on the ceiling and take on the guise of custom-built equipment.



A lighting intensity of 160-foot-candles confined to the display counters is produced in this very modern jewelry store, from an installation of Permaflector Built-In Lighting. Recessed wall display cases are also illuminated from built-in lighting equipment.

A total of 21 direct lighting units of the "GR" type are employed for the lighting of the Garland Sport Shop, at Wenatchee, Wash.

An average intensity of 14 foot-candles is produced in this modern market from an installation of 516 specially built direct lighting units.

Lighting from Concealed Sources

The amazing thing about Permaflector Built-In Direct Lighting is the fact that very high intensities, 30 to 50 foot-candles, can be delivered to the merchandise with nominal wattages. Over limited areas, as in the jewelry store above illustrated, an intensity of 160 foot-candles, at nominal energy consumption, is available.

Diffusing glass plate, or roundel, conceals the reflector and lamp and is used for low mounting. For high mounting, concentric louvers are used. For illumination confined to show case area, louvers are employed.

Write to our nearest representative (listed below) for complete details on this modern built-in direct lighting equipment. He will be glad to work with you on any specific installations.

PITTSBURGH REFLECTOR COMPANY

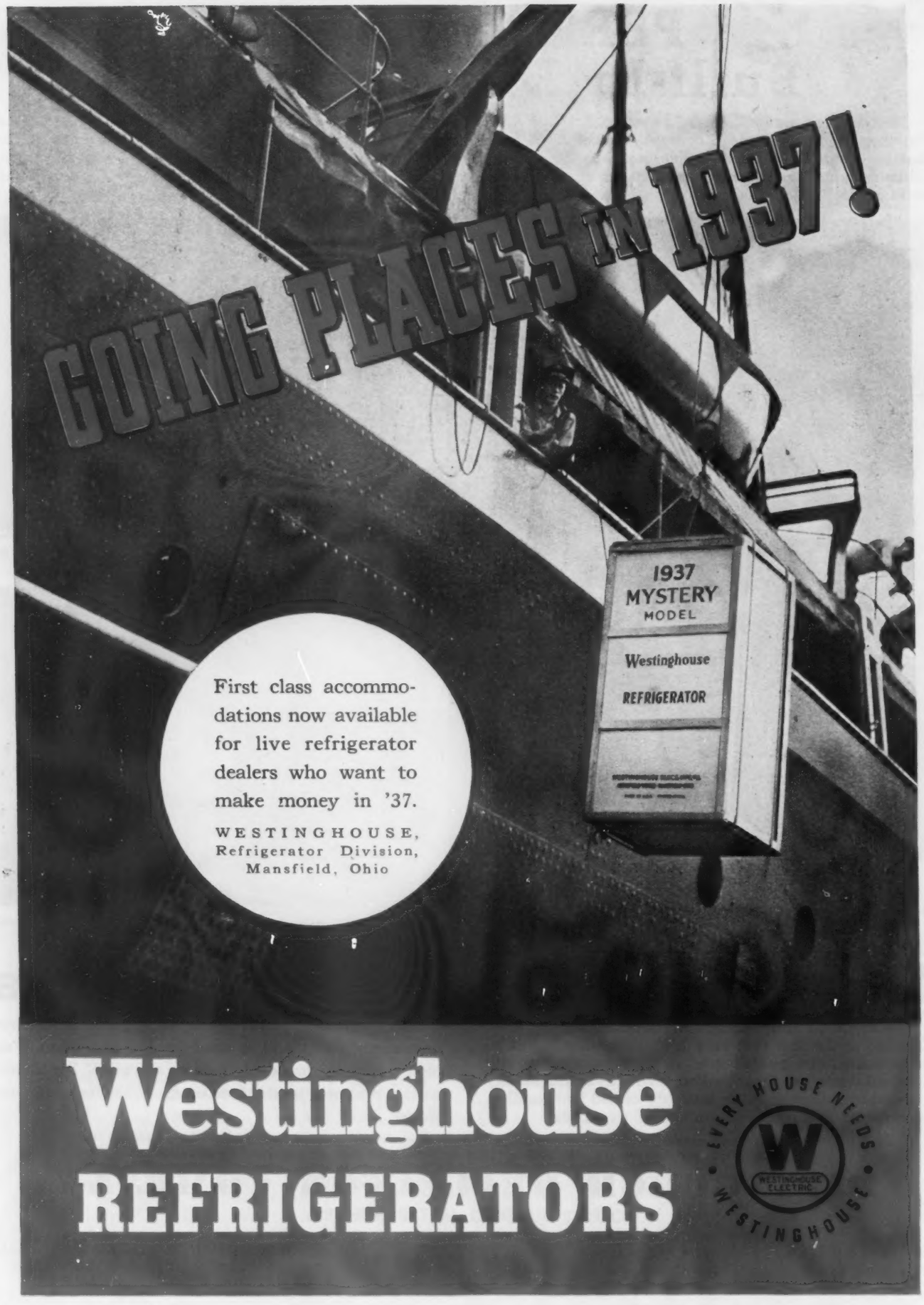
OLIVER BUILDING, PITTSBURGH, PA.

FRANK E. HASTINGS
810 Transportation Building
LOS ANGELES

HAL. A. GARDNER
1440 Portland Ave.
BERKELEY, CALIF.

RAYMOND ACKERMAN
318 Dooly Block
SALT LAKE CITY

LYMAN D. MORGAN
239 Securities Bldg.
SEATTLE


GOING PLACES IN 1937!
1937
MYSTERY
MODEL
Westinghouse
REFRIGERATOR
First class accommodations now available for live refrigerator dealers who want to make money in '37.
WESTINGHOUSE,
Refrigerator Division,
Mansfield, Ohio
Westinghouse
REFRIGERATORS
EVERY HOUSE NEEDS
WESTINGHOUSE
W
WESTINGHOUSE ELECTRIC

ELECTRICAL WEST

[*Devoted to the economic production, transmission and distribution of electric power and its application to industry, commerce and the home in the Pacific Empire, and to the sale and distribution of electrical utilization devices, equipment and appliances in that area*]

December 1936

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A Palace for the Industry

Further Progress of the Golden Gate International Exposition

By CHARLES L. HUYCK
Graybar Electric Co., Inc., San Francisco

OUR electrical industry, above all its fellows, is most vitally concerned in the success of the Fair, not only because of a Palace of Electricity whose scope and variety will make every electrical man proud that he is one, and not only because of a magical and unparalleled use of electricity throughout the grounds, but also because of the electrical preparations for housing, feeding, and amusing the visiting millions who will flow through the Pacific Coast's tourist conduits and flumes—flumes especially because, as in placer mining, that stream will deposit gold as it flows. But before proceeding to a consideration of the section dearest to our hearts, let us first bring our general information down to date.

Prior to the recent unveiling of a 30 by 18-ft. architectural model in San Francisco's City Hall, the Exposition layout, to most of us, was more properly a layette—just a series of pleasant conjectures over the coming blessed event. It has seemed no more than such a cluster of domes and towers as we see in the piled up clouds of sunset, but now we know that Architectural Chief George Kelham and his apparently Lost Battalion of architects and designers have been putting foundations under that dream city.

The first foundation, of course, was the island upon which the Fair is to rise. Like a new Moby Dick it has humped itself above Yerba Buena shoals, and the giant siphons and buckets of nine dredges have been humping themselves too, at a rate of nearly three million cubic yards per month.

Meanwhile a barge navy has been subtracting forty thousand tons of riprap per month from quarries along the adjacent Marin and Napa shores, and floating it out to an eighteen thousand-foot seawall intended to insulate the island from wind, wave, and weather. As we go to press, the island is 55 per cent and the seawall 85 per cent completed; and by February 1937, just one year after reclamation began, this 400 acre man-made trestle board will be about ready for whatever design it may please the Grand Architect to draw. And it must be remembered that the G.G.I.E. on its custom-made "Midway Island" is the first fair in history whose effect upon the beholder five to ten miles distant has been calculated. This fact, as will be seen, has powerfully influenced its electrical ensemble.

Preliminaries

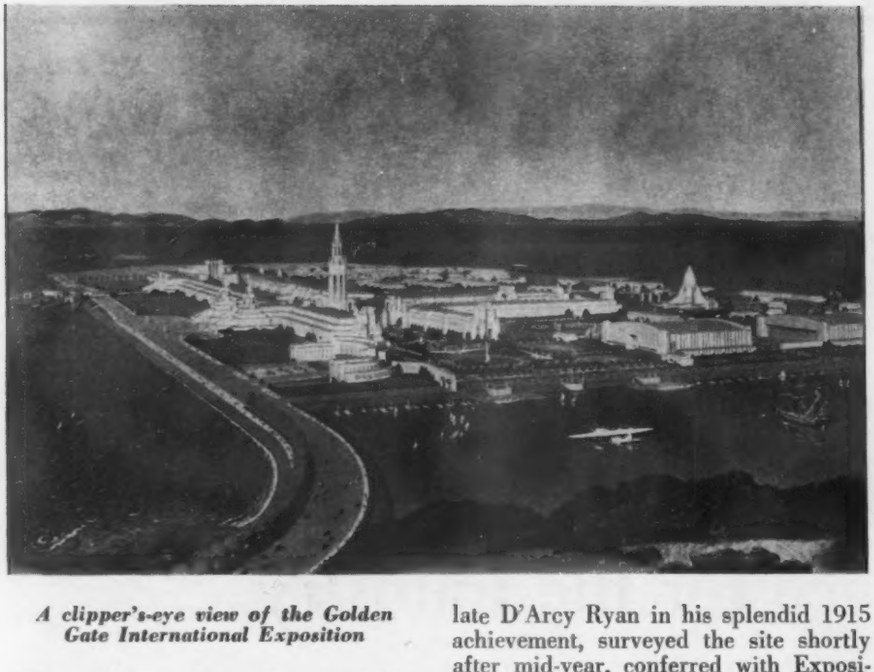
The seawall cost $278,250 and was built by the Marinap Corp. under contract with the United States Engineers; Army engineers themselves handled the island fill at an estimated cost of $3,803,000.

The first group of major building awards covered $140,781 to Lindgren & Swinerton for the temporary administration building at Bush and Stockton Streets, San Francisco, on Board of Education property (later to revert); $331,600 to Healy-Tibbitts for one freight and three passenger ferry slips on the island; $736,000 to MacDonald & Kahn for two airplane hangars; and $677,000 to Clinton Construction Co. for an airport administration building.

These last three structures are to be permanent units of San Francisco's new municipal airport. Meanwhile they are enrolled as exposition palaces. The airport terminal building, a three story semi-circle, 350 ft. from wing to wing, with a 19-ft. observation platform running its full length, and a 150-car basement garage, will become the exposition administration building.

The twin airplane hangars, each 335 ft. long, 275 ft. wide, and 42 ft. high at the center of their arched doors, will serve as exhibit palaces; and as their main doors are 200 ft. wide, there should be no difficulty in getting in on the ground floor!

You will see this arc and these twins, cleverly fitted into the general architectural scheme, to your right as you swing off from the Bay Bridge on a six-lane roadway, 64 ft. wide and half a mile long. It leaves the bridge immediately west of the tunnel, curves around the slopes of Yerba Buena for 90 degrees, parallels the entire west frontage of the Fair, and debouches upon a monster parking area occupying the farther or northern end of the island. This causeway will be lighted with the same



A clipper's-eye view of the Golden Gate International Exposition

yellow sodium units used on the bridge itself, and Electrical Chief Earl English plans to make it a veritable Path of Gold. Or so hope his fellow chiefs in charge of receipts and admissions!

All these details occupy the same relative position in the plan above as they would to a visitor arriving by car or boat. You will note that the court scheme so successful here in 1915 has been adopted to capture sunlight and to act as a series of barriers to winds which are sometimes brisk, even in a world-renowned landlocked harbor.

Court Lighting

The outer courts will be as white as paint by day and floodlights by night can make them, their incandescent glow broken only by necessary entrance arches and contrasting clumps of shrubbery. A veritable barrage of floodlights will be firing at this outer wall as at a fortress, for remember that the primary impression of the Fair will impact from afar upon those who approach it by car, craft, or clipper.

The inner courts, on the contrary, will be a gorgeous burst of color, and all the brilliant hues which unite to form the white light outside will here be broken up into man-made rainbows. Bizarre color effects, purely as such, however, will be banned, just as grotesque buildings will be warned off the Fair proper into the amusement section.

The General Electric Co. has been awarded the contract covering the entire exterior lighting of the Fair. Two Nela Park engineers, A. F. Dickerson, manager of the illuminating engineering laboratory, and J. W. Gosling, decorative designer, both associates of the late D'Arcy Ryan in his splendid 1915 achievement, surveyed the site shortly after mid-year, conferred with Exposition officials, and returned to their factory for serious work on the creation of what Mr. Dickerson declared would be "an illusion, at night, of a magic jeweled island floating in air over the middle of the Bay." They will return in January to submit a general scheme of illumination for both buildings and grounds and will install test equipment. Their study will also take into consideration the approaches to the Fair and possibly certain portions of the San Francisco skyline.

The main Exposition axis runs north and south, the secondary axis east and west, and each is flanked by pairs of exhibit palaces broken only by the intersection. The main avenue terminates at the farther end in a circular open-air theatre, at the nearer in a series of magnificent gardens. These gardens, as always in California expositions, will be a headline feature, and $500,000 has been appropriated by the WPA for their propagation and installation. And art will assist nature—or rather, electricity will hasten natural processes—by an elaborate soil heating system using electric cable, now operating at Balboa Park, in San Francisco.

Grand Entrance

The secondary axis bisects the main avenue at about one-third of its length, and will be a superb architectural vision with its monumental entrance pylon suggestive of Benares and Madura, its soaring triumphal arches, and its placid lagoon reflecting an impressive architectural mass which, anonymous as yet, is convertible into a cascade or a sculptured cliff. This will be the second tallest structure of the fair; the topmost tower crowns the junction of the two avenues and will focus the entire Exposition electrically and architecturally.

In place of many small exhibit palaces there will rise a majestic interconnected series, separated within by partitions and capable of being sliced off in cake-like segments divisible as minutely as forty feet. This measurement conforms to the entrances, columns, groups of sculpture or shrubbery, and other details.

Palaces

The exhibit palaces will be approximately 450 by 275 ft. with a height of 60 ft. at the apex of their elliptical girders. The exact number has not yet been decided, nor, of course, a complete list of their names, these matters being contingent upon the efforts of the exhibit chiefs. However, it has been decided to use the conventional nomenclature of previous exhibitions, such as Manufactures, Liberal Arts, Varied Industries, Machinery, Transportation, Mining and Metallurgy, Food Products, Education, and Fine Arts, the last two being about two-thirds the dimensions of the others. There had been some talk of "purpose" names such as a Palace of Health and the like, but it was felt that such groupings would inflict a piecemeal effect upon visitors and increased expense upon exhibitors.

You will note in the model that all these structures are windowless, thus giving electricity a spectacular opportunity to supply equable light, heat, and air in place of the constantly shifting natural varieties. There is another argument, too, for the windowless building, amply justified by such structures as Hersey's, and that is the elimination of distracting noise.

Light Studied

Electrical Chief Earl English has asked the cooperation of local lighting experts in establishing interior lighting standards for the Exposition; and a group of twenty-four manufacturer's representatives, under the chairmanship of Rodney Doerr of the Pacific Gas and Electric Co., have been pooling their illuminating experience. The findings are still in the formatory stage, pending a series of exhaustive tests with various units to determine their fitness for the wide variety of structures to be lighted, ranging from main exhibit palaces to tiny kiosks and sideshows.

And what of our official representation? Our product will permeate the entire Fair in all its phases and render unto visiting millions the same services it ceaselessly bestows upon each home or business group without getting any medals, tips, or engraved cards of thanks for it. (Suppose ELECTRICITY himself would go on strike!) It will also be counting crowds with its elec-

tric eye, controlling crowds with its far-reaching voice, inflating lungs with its air-conditioning bellows, and tracing lost and found articles and infants by television.

But beyond all this workaday aspect, electricity will have a holiday chance, too, to show its prowess, with a building all its own, in a desirable location to the right of the main entrance facing the ferry landings. That our industry is to have a separate palace for its products, instead of scattering them through a score of buildings with consequent diminution of effect and augmentation of expense, is largely due to the initiative of a committee from the San Francisco Electrical Development League, which, for a quarter century, has been an adequate host and forum for all local branches of the industry.

Halloran Appointed

The chairman of this group is Arthur Halloran, whose service has been largely spent at the railheads of industry, up on the frontiers where the laboratory secrets of one decade are becoming the factory products of the next. And his sterling worth and lifelong friendships with our leaders have been recognized by Exposition Director of Exhibits Waldo Tupper, who has stated he will be made chief of the building dedicated to the electrical industry. Upon his salesmanship, tact, and resourcefulness will depend the size, character, and effectiveness of that building, which he has happily christened the Palace of Electricity and Communication.

It is significant that *practical* romancers such as Kipling and Wells have always emphasized the importance of communication as a civilizing factor and executive force. Skilfully directed machines do our work, commerce populates our offices and factories, the whole wide world is our cupboard and our warehouse, but all these activities are coordinated by electrical communication—the millions of voices that are pulsing over wires or thrilling through the ether this very second.

Dramatization

And so Chief Halloran envisions a huge animated model occupying one entire end of his palace, graphically portraying the wire network which puts the ear of the entire world in touch with your telephone transmitter, and especially its ramifications along the Pacific Coast. Out beyond that coast, over the shoulder of the Pacific, he would show the great circles of radio stations, and the beacons which guide the clippers, and the trails of shell-encrusted cables, and the tiny islets—"ringed by dark purple spheres of sea"—of those who serve them.

At the opposite end of the palace, Chief Halloran would portray the power industry in a corresponding animated model, as wide as the building and towering up to its roof. There would be snow flurries far up in those sixty foot mountains, and dams and lakes and plants and stations, and lines and flumes with their devoted attendants, and all the unseen intricacies of a servant who ultimately manifests himself in a switch or an outlet.

The Palace will contain two auditoriums whose occupancy will be free to exhibitors and pro-rated among them according to their floor space. Their prime purpose is to interpret service, and the discussions and demonstrations given therein must be educational rather than advertising. So rapidly are we progressing that electrical assistance undreamed of in 1936 will be employed in the presentation of these talks in 1939.

Though heavy machinery, such as prime movers, would ordinarily be assigned to a Machinery Hall, and electrical locomotives to a Transportation Building, still such apparatus should at least be represented by maps and models in the Electrical Palace. On the other hand, as the simplest electrical gadget is often the product of the same scientific reasoning, it too should be represented so that, in general, the Palace would house small-scale models of big things, and large-scale models of little things.

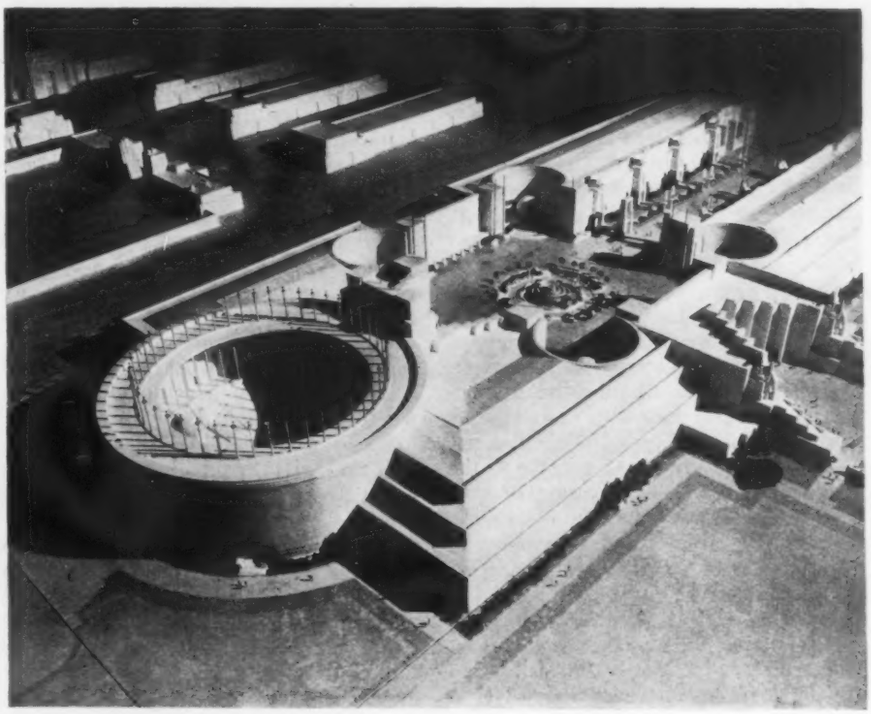
How few householders are cognizant of the wiring network within their homes, so alert to serve their every need. Yet how can such a network be adequately portrayed? We are all familiar with sample boards which hang decoratively in the city sales departments of various wholesalers, but wouldn't a better method of impressing the use of wiring devices be a glass cross-section of a house with all the wiring complexities in plain sight in their proper place, on the job?

Another suggestion is that the Market Street Railway present a historical display of their evolution of transportation, from the horsecars and steam dummies of early days, through cable cars which are now considered museum pieces, down to the trackless trolley coaches of today.

Variety and Force

From seed-like surgical lamp to dinosauric turbine, all these electrical exhibits range the whole spectrum of American industry—and beyond into infra red and ultra violet! Broadly speaking, they may be classified as *things* which give a service or as *service* which operates those things, but their ensemble must be considerably more than that of glorified sample boards or country fairs or window displays, excellent as these are in their familiar fields. They must show the idea even more than its fulfillment, in action rather than static, and furthermore must be cleverly calibrated to register beyond the fatigue of sightseeing.

A closeup of the model of the open-air theater, main entrance and other architectural details of the northern end of the Exposition



Bill Jones Speaks + + +

On Going to Work for a Change

"WELL Bill, after the kick in the pants the New Dealers have given us, I'm prompted to lock up the office and let Uncle Sam take this business," said the Manager. "It looks like we're licked. So I'm going to call in the hired help and tell them it's no use to fight the rising tide of bureaucracy any longer. We're washed up and we might as well admit it."

"Oh, so you are just plain yellow, eh? Can't take it. If mama's fair-haired boy can't have things like he wants 'em, he's going to pout and won't play any more. If he can't make up the rules, he will wreck the game. The biggest difference between a peanut and a big man is that such a statement might be expected from the peanut," grunted Bill Jones in disgust.

"Yeah!" shouted the Manager indignantly, "I suppose that you——."

"Calm yourself," grinned Bill. "Don't let your blood pressure soar. I know that you are not a quitter—just a little dismayed and momentarily discouraged. You have been brought up in a school of thought that accepts certain things as immutable economic and social truths. Now are they? Perhaps, and perhaps not. One thing certain is that you have worried day and night the past few years about things which you were sure would happen, and they haven't happened—at least to any destructive degree thus far. Congress slapped you on the wrist with a discriminatory 3 per cent tax on electrical energy sales, and your business has been forging ahead with leaps and bounds ever since—not because of it, but despite it. The holding company bill and its understudies threatened ruin for some, but nothing has happened so far. Then came the 'yardsticks' which were also going to wipe you out of business. They haven't. Government funds to subsidize municipalities to build their own power plants were certainly going to bring disaster. It hasn't done any lot of damage to the industry as a whole. Increase of general taxes to pay for social security, bonuses for farmers and veterans, and labor and almost all other organized groups was, or is, sure to result in unbalanced budget. Maybe so, but the fact is that on the Pacific Coast at least you are enjoying better business than you have for many years. So what!"

"Some of what you say is true, or at least is partly true," rejoined the Manager, "but we have been sitting on pins and needles for nearly four years, not even certain of anything except uncertainty. We can't plan ahead; we are just helpless. Even the boys down the line have absorbed the general atmosphere of the situation. They don't know what is going to happen to them and ——."

"Just so," said Bill, "and there may be where your leadership has faltered. Snap out of it. Get your head up and mobilize the brains of your organization again. Government or no government, there is great work to be done. Great leaders drive ahead, and like your childhood hero say, 'Damn the torpedos!' Get your gang together at a good dinner, or a series of dinners; introduce a little entertainment that will make them laugh and be cheerful, and then make them a little talk something like this:

" 'For three years I have been sitting in my office alarmed at ghosts which in my imagination seemed to threaten the greatest industry in existence, and you have suffered and have wondered, and have reflected my pessimism as to the future. Well, we aren't going to do it any more. While I have been moping here thinking myself and the company into the poor house, and have all but utterly destroyed your morale, I have let things slide as much as possible until you and I have accumulated a tremendous lot of work which should have been done before. We are going to wade into it beginning right now and we are all going to get busy to perform the functions of a real public service company. And we aren't going to think in politics any longer. Instead we are going to sit up nights and perform miracles of service for the people who pay for it. Probably a lot of things will come down from Washington or elsewhere which might be contrary to our ideas of what should be done, but we can, and will, adapt ourselves to them and make them tick if we get into the line and work.

" 'Individual progress and collective progress is likely to be very much a state of mind. To you young men and women, just remember that whatever happens or doesn't happen, the electric light and power industry still offers you great promise; even if it goes into other hands, but it won't. The President isn't going to pack the Supreme Court; he isn't going to destroy the very agencies which he sorely needs for recovery. Some of our methods are likely to be changed. If so, we can change them, and will.

" 'Our great industry needs ideas—lots of ideas, especially new ones to replace the shop-worn ones of past generations. Probably the minds in this room could solve many and possibly all of the vital problems confronting it. You and I are going to get active devising ways and means of whipping them into action. For years some of the people have promoted a crusade against the utility and the size of the smallest bill they pay, blissfully ignoring all other considerations of far greater importance. The pot is bubbling away and occasionally we are throwing in this and that ingredient endeavoring to brew a concoction which will cure this peculiar manifestation of the public mind. We are making some progress, but the real solution is still open and free to anyone—perhaps to one of you.

" 'Under similar conditions, some companies are selling 400 kilowatt-hours to their residential customers and others are selling 1,500. An idea that is good and is new will quickly bring up the 400 kilowatt-hour customers to 1,000 and send the 1,500 skyrocketing. The field is fertile and begging to be tilled. Who will produce the idea?

" 'We need some snappy ideas on selling our service. There hasn't been one such which wasn't old when Noah sold the idea of a free ride with free board to the animals. Somebody has said that Henry Ford has marketed more automobiles than there are wired homes in the United States. Maybe the reason he has done that is worth studying—really studying. As long as there are more radio sets than electric irons in use, our job has not been completed.

" 'People must have bread. It is considered necessary to their existence. What would be our comment upon learning that bakers supplying that essential could not so conduct their business as to make a reasonable profit? There is more similarity in the two situations than we old-timers like to admit. We have done a great job in creating desire for our service, but we haven't learned the trick of persuading people to enjoy paying what that service costs. There are a dozen vital problems in this branch of the industry which any man is just as likely to solve as is any other man. Technical knowledge of the business is unnecessary. It may well be that

those of us who have been with it so long and are so familiar with it are handicapped by persistently clinging to many things which aren't true.

"'Somewhere in this broad land of ours is as yet an undiscovered genius who instead of bewailing the impending ruin is going to capitalize it to the advantage of us all. Here is a wide open opportunity worthy of the best thought of any man in any position. I hope he will be found among you here tonight.

"'As for myself and our company, we are going to cease being frightened at every wind that blows; in our ranks we are going to resume the orderly process of promotions and salary increases which was halted back in the days of gloom and apprehension. Whatever comes, we are going to do a better job and do it more intelligently, because we are going to work harder. And because you and I believe in our industry and believe in our abilities from this very night, watch our smoke. To hell with politicians and defeatists. We're going to be damned busy from now on.'"

+ + + by Electra's Husband

Engineering Human Nature

"NOW, here's a sensible question," quoth Electra while engaged in skimming the evening paper for bargains that she knows very well she can't buy. "This editorial asks why it is that little men like you can build big things like Boulder Dam and the bay bridges, and clipper ships and television and yet cannot devise an economic system that will feed the people and provide jobs for those who want to work — in other words, do a little social and economic planning for a change. I'll bite, why can't you?"

"Do you want to know the answer or are you just belittling again?" I thought was a fair question.

"Humph! Think fast, captain. I'll bet you never gave it a thought."

"Yes I have. I have asked myself the same question. But it wasn't until the other day, when I sneaked past the guards and watched the crews at work on the remaining big bridge that I caught the answer. One of the big bay bridges had just been finished. In going over it the impression I got, and thousands of us who went over had it, too, was of the finished job—massive, complete, magnificent. But this other day at the Golden Gate bridge I happened to see how infinite the tiny details were. It had never come to me before, why even such a little thing as an inch cube of steel, welded to a fabricated truss made of reinforcing rod, and "tacked" to the bridge girders by an arc welder—the idea that even that little piece of metal had been calculated, drawn on a blueprint, tested as to its ability to withstand the stresses and strains it would have to take as traffic roared over it far into the future, drove itself home to me.

"Inquiry also revealed to me that though we had wished for these bridges across the bay for 50 years or more, neither of them would have been possible without some of the technical improvements in steels and concrete and other materials which have only been developed within the last few years."

"And what has all this tiresome technical jargon of yours got to do with my question?" Electra reined me up with that.

"Just this, my dear. That our knowledge of the materials with which to build social systems and do economic planning is relatively still way back in the dark ages."

"What materials?"

"The chief ingredient being man — and woman. Why even the beginnings of scientific inquiry into the *physical* nature of man, of his blood circulation, for instance, only dates back to Harvey; of evolution of the species to old Darwin. And old doc Freud, whose spicy conjectures into the love life and emotional nature of man were the beginnings of today's most elementary study of human nature, is still alive. His primitive experiments in human behavior are at about the same stage of progress yet that the physical experiments of Francis Bacon were in Elizabeth's reign, or that the apple bouncing off of Newton's head was in his day. We are making rapid progress in these studies of the stresses and strains on human nature, of the capacities to carry social loads and responsibilities, of the breaking points and the tensile strengths, but we are just beginning.

"It is no wonder our social systems or cooperative plans break down under load. We just wish them into existence instead of building them out of the materials at hand, and with due regard for the weaknesses of those materials. We expect people to be angels enough to liquidate all of their selfish and self preserving instincts in order to achieve an ideal of culture and civilization. Yet we know better than just to wish a bridge into existence and hope it will stand up.

"But even engineers and business men and professors in high authority, yes, even presidents and potentates, do one kind of thinking when they build a chicken coop or a bridge, and another kind when they visualize a program of cooperative or collective action, or a social system, or an economic plan."

"So what?" from Electra, with a lift of her neatly plucked eyebrows.

"So let's not put the cart before the horse. I recall another of a multitude of misleading admonitions that we give youth which ought to be turned around a bit, too. Instead of telling them to hitch their wagon to a star, it would be far more sensible to advise them to hitch their star to a wagon, a good matter-of-fact wagon that has four wheels on it, all touching the ground. As it is now they burst out from college intoxicated with idealism and imbued with an idea that they will rebuild the world. Trouble is they start rebuilding up on cloud nine instead of digging down into the muck and dirt of humanity to bed rock and starting the foundations on hard fact."

"But I thought you just said that it was the human weaknesses of *men* that made all these beautiful ideals of bettering our social conditions impossible?" asked Electra.

"That's just what I've been trying to tell you, we need to know more about people——"

"Why I could have told you all that in the first place. I know you men."

I guess I don't know so much about women, however.

Electric Insect Control Successful in Vineyards

Three years of experiment supported by the California C.R.E.A. show how electricity can benefit agriculture through control of insect pests

ELECTRICITY has a new role to play in agriculture. Its ability to lighten the burden of farm labor has been demonstrated; it can economically and efficiently pump water to land otherwise untillable. Now it enters the field of entomology as a destroyer of those insect hordes against which the farmer must compete. Intensive research and practical field tests are demonstrating that colored electric light coupled with the lethal effects of high-voltage current constitute a potential weapon of the first order against the insect enemies of the agriculturalist.

How this is being accomplished is demonstrated in the field experiments which have been conducted by Prof. W. B. Herms and Joe K. Ellsworth, of the University of California, through the cooperation of the Agricultural Experiment Station of the university and the utilities of California under the patronage of the C.R.E.A. Success to date indicates that two of the principal problems of agriculture may be open to solution through this latest application of electric service. They are first, the damage to field crops by insects, estimated at $26,000,000 annually in the case of California alone; and second, the increasing vigor with which food and drug administrations and health authorities are enforcing government regulations pertaining to dangerous chemical residue on fruits and vegetables resulting from the use of toxic chemical sprays and dusts.

Three years of work in California vineyards indicate that the grape leafhopper, responsible for millions of dollars of damage each year, may be controlled effectively through the use of electrically lighted electrocutors. Experiments have been conducted in vineyards near Delano, Madera, Modesto, Escalon and Tracy, the results of which are now available. In each case the effectiveness of the light trap for control of the leafhopper has been conclusively demonstrated. Also the technique of installation has been worked out. Thus the vineyardist is able to produce a better crop, with high standards of quality commanding a premium price.

This experimental work is based upon many years of research growing out of the observation that light exercises a powerful influence over the behavior of many insects. Laboratory experiments with monochromatic light developed the fact that different insects react to different colors and that even the two sexes of the same species had different color reactions. Having proved that color exerts a selective influence, it was possible to attract certain insects and exclude others.

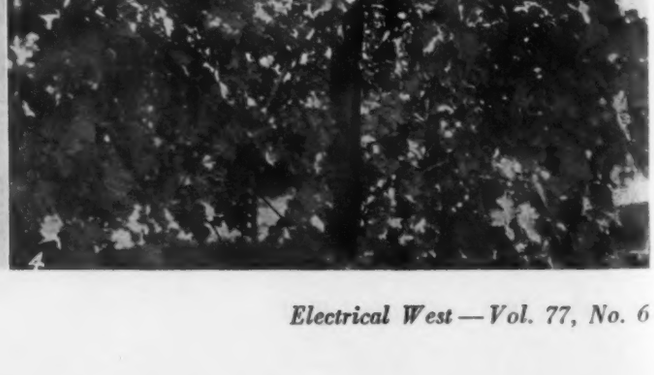
In the case of the grape leafhopper tests were made with red, midnight blue and pale blue gaseous discharge tubes and white and daylight mazda lamps. Equipment used in these and other tests was particularly designed for the work and was made by Dr. L. T. Jones of the Monolite Co. of Berkeley. Pale blue 120-watt discharge tubes proved most effective.

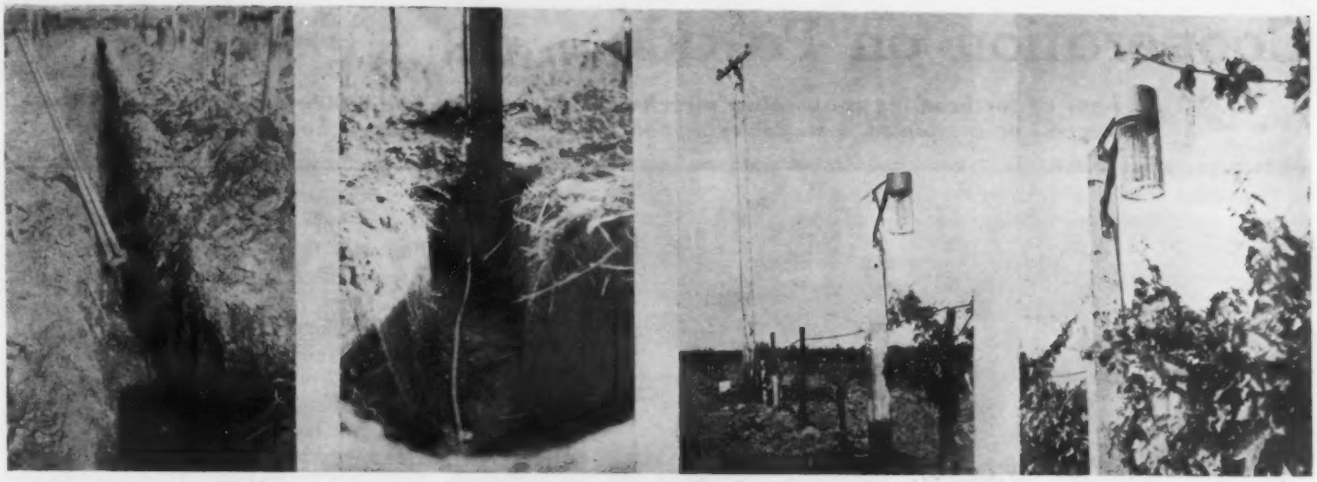
Success in the control of the leafhopper was found to depend upon some means appropriate to that phase of the life cycle which was to be attacked. In past practice oil-pyrethrum spray had been used effectively against the first brood of immature hoppers. Cyanogas also was successful when weather conditions permitted its application. However, because the hopper is constantly dispersing from one infected area to the fields adjacent, whatever method of control was employed had to be consistently repeated. Obviously the daily removal of gravid females throughout the season from any given area would constitute an ideal method of control. With present-day chemical methods this is impossible, principally on account of the expense. The insect electrocutor, once installed, was found to destroy economically both the local adult hoppers as well as the invaders.

From the field experiments it has been found that one trap per acre provided the most effective control. Locating the traps is a problem of engineering which must be done by one familiar with their effectiveness. Location is determined by the shape of the vineyard and the possible lines of invasion from adjacent vineyards.

Two methods of installation have been employed, each of which uses tellurium cable. Lines may be placed underground with taps running to posts set in the vine rows on approximately 200-ft. centers. The cable must be located at least 18 in. deep to permit cultivating and sub-soiling operations. A less expensive procedure is to run the cable along the tops of the grape stakes to posts having crossarms for the support of the lamps at a height just above the top of the maximum vine growth. Both methods are shown in the accompanying illustrations. Automatic con-

Effectiveness of control with electrocutors is shown in the picture at the left, where healthy and sturdy leaf growth protects the fruit from sun and wind. Compare this with the vine at the right which was in one of the check fields treated with oil-pyrethrum and cyanogas





Methods of installing the electrocutors in a vineyard are shown in the views above. The two at the left show underground installations of tellurium cable, including a tap for one of the posts. The other two views show the cable placed along the tops of grape stakes, together with the method of mounting the lamp

trol is employed. A time switch operates the lights from dusk to dawn. Since temperature has a decided effect on the habits of the hopper, a temperature switch is also essential for the most economical operation.

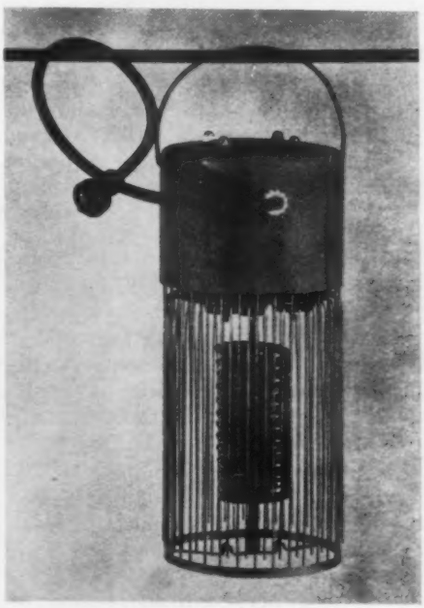
Typical experiences taken from the experimental work over the past three years reveal the value of the insect electrocutor as an effective and economical means of control. Near Delano an 8-acre vineyard belonging to A. A. Green was equipped with one trap per acre. Annual operating cost has averaged $15. In previous years the cost of treating the vineyard with oil-pyrethrum and cyanogas has amounted to $80-$100 per year. The cost of the light trap installation is approximately equal to the expense of two years of chemical treatment and the subsequent cost will consist only of the energy used.

Most of the grapes from Mr. Green's vineyard were sold as "table" quality due to the reduction of fecal deposits and the absence of toxic chemical residue. In addition to the grape leafhopper, the hornworm, cut worm, corn earworm and armyworm were controlled by the electrocutors.

Eight electrocutors in the vineyard of W. Davis at Modesto provided such successful control that the vineyard produced 76 tons of Thompson seedless grapes (9.5 tons per acre) which sold as number ones with a sugar content running as high as 26 per cent. Both yield and sugar content were much higher than the average for the state. At Escalon 63 tons of grapes were harvested from the 6-acre field of O. T. Gardner in which six electrocutors were installed at a cost of $190. Fifty-eight tons sold as number ones. The yield of 10.5 tons per acre is double the usual yield for this variety, and the price was $4 per ton higher than that secured by neighbors. Two blue ribbons were won by these grapes at the San Joaquin County Fair.

Application of the electrocutors to successful control of insects attacking vineyards supplements the successful work which has been done in artichoke fields with the artichoke plume moth. Experimental work is now being undertaken on insects harmful to tomatoes. During the past season this work was directed primarily toward discovery of the satisfactory color and intensity and the number of traps per acre necessary to give effective and economical control. Thus the field of application for this latest electrical boon to the farmer is being slowly and scientifically extended.

Type of Monolite electrical insect electrocutor used in control of the grape leafhopper. The light source is a pale blue gaseous discharge tube



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Air Conditioning Applied To Storage of Seeds

Air conditioning has been applied successfully and economically to large scale storage of seeds. One of the most vital problems confronting any large seed company is that of maintaining proper temperatures and humidities in seed storage rooms. Both temperature and humidity have been found to have a definite effect upon the germination qualities and the health of plants produced from seeds which have been stored over a considerable period of time.

Experiments conducted in the seed storage rooms of a large southern seed company have proved that proper air conditioning produces a much higher rate of germination. As a result two large installations of Westinghouse air conditioning equipment have been made in its store rooms. Cold storage fees will be saved and exact temperature and humidity conditions will be maintained for the specialized product which this firm handles.

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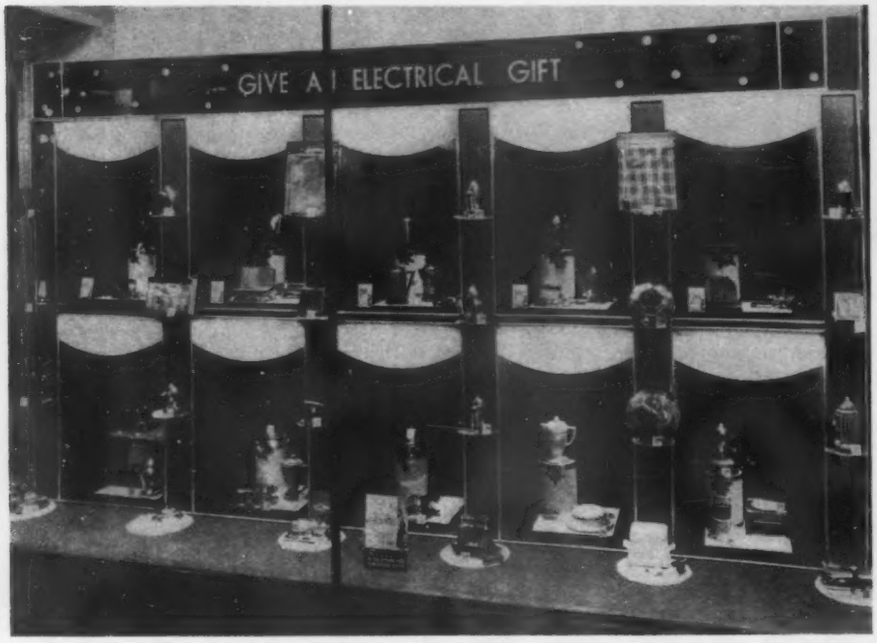
• STIMULATION of rural electrification was the purpose of a meeting which last month assembled 100 rural electrification salesmen of the Utah Power & Light Co. at Newhouse Hotel, Salt Lake City. Dr. Adam S. Bennion, assistant to the president, pointed to the company's enterprise, which has electrified 94 per cent of the Utah farms with dwellings valued at more than $500. Among the speakers were P. M. Parry, vice-president; M. L. Cummings, advertising director; K. W. Browning, in charge of rural electrification, and J. F. McAllister, superintendent of residential sales. W. A. Huckins, sales manager, presided.

Cooperation on Parade + + +

[*Forecast of forthcoming cooperative merchandising activities, and review of activities in progress or completed, a summary of cooperation at work throughout the West*]



Christmas Appliances

Alert dealers everywhere will feature electrical appliances for Christmas gifts this month. Even the big chain stores, like Sears Roebuck, tie in with this theme, as shown by a clever window at the Salt Lake store last year. Note how the appliances are individually emphasized by a niche for each one

Christmas Jubilee Gets Underway in Rockies

With electrical expositions in scores of communities as a preface to specialized promotional efforts, the Christmas Electrical Jubilee was opened in six states under sponsorship of the Rocky Mountain Electrical Assn., and the Electrical League of Colorado. States participating in the outstanding cooperative enterprise are Colorado, Idaho, Montana, Nebraska, New Mexico and Montana.

Added to emphasis placed on Christmas lighting, radios, and the continuous I.E.S. lamp campaign, is the drive for electric cookery. A pie-baking contest will be a high-light of the jubilee. Rules provide that electric roasters will be furnished contestants with $25, a roaster, and a floor lamp as prizes.

Opening expositions, which focused attention on the theme "Electrical Gifts for Christmas", were scheduled to precede National Electric Housewares Week, Dec. 7 to 12. Christmas lighting contests will conclude the season. George E. Lewis, association and league manager, said $25,000 will be used for promoting the jubilee campaign.

Bermuda Trip Offered for Appliance Window Prize

BERMUDA again beckons electrical dealers to make the most of Electrical Housewares Week Dec. 7-12 for again the housewares program sponsored by twelve manufacturers and the Edison Electric Institute offers a 6-day, all-expense cruise to Bermuda for the best window display. Window display entries must be installed and serve the public during the week of Dec. 7-12 and feature the products of at least one of the manufacturers sponsoring the week. Large appliances, such as refrigerators, ranges, radios, and washing machines, are not to be included. A large poster supplied must be included in each display. There are prizes for central stations, department stores and other dealers. For the best window or interior display in each case will be awarded a 6-day, all-expense cruise to Bermuda or $75 in cash.

Wholesalers too can compete by submitting window or interior displays by the largest number of central stations, department stores or other dealers in their territory entering the contest. Photos of the displays with names and addresses of contestant printed on the back are to be sent to Contest Editor, Edison Electric Institute, 420 Lexington Ave., New York, before Dec. 26.

Manufacturers sponsoring the program include American Electrical Heater Co., General Electric Co., Hamilton-Beach Manufacturing Co., Knapp-Monarch Co., Landers, Frary & Clark, Manning-Bowman & Co., Proctor & Schwartz Electric Co., Robeson Rochester Corp., Swartzbaugh Manufacturing Co., The Silex Co., McGraw Electric Co. (Waters-Genter Division) and Westinghouse Electric & Manufacturing Co. Available also are display posters, newspaper mats, stickers and news releases and radio spot announcements and suggestions.

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Exposition in San Diego Opens Holiday Season

AS its 4th annual electrical exposition opened Nov. 28, too late for a report in this number, but with all space signed up and every indication of overwhelming success, some stock of the year's achievements in San Diego under the activities of the Bureau of Radio and Electrical Appliances of San Diego County was taken in a recent report to stockholders of the San Diego Consolidated Gas & Electric Co.

Representing 146 electric appliance dealers in the company's territory cooperating with the Bureau up to Sept. 1 a total of 6,360 electric refrigerator sales had been made in comparison to 5,035 in 1935 for the same length of time. There had been 7,300 radio sales made against 7,075 for the first eight months of 1935. It was also reported that an estimate of 746,973 visitors have been entertained at the Palace of Electricity during the exposition in San Diego this year.

The annual Christmas show this year, instead of being held on the second floor of the Municipal Pier Building had much larger quarters in the Palace of Better Housing in the exposition grounds, Balboa Park. The show also opened one week earlier than last year, and provided dealers with a better opportunity to capitalize upon the publicity of the exposition. A full report of the show will be given in the January number.

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• PORTLAND ELECTRIC CLUB staged as its Nov. 25 meeting a big Thanksgiving party with turkeys given to the winners.

Planning Committee Outlines Southern California Program

TO move up behind the remarkable publicity obtained during the Boulder Dam inaugural and the Electrical Age Exposition with a program to consolidate the gains made in public acceptance of the electrification of homes and commercial establishments, the Electrical Development League of Southern California drove into its organization of 1937 plans. The annual election of a board of trustees was held early in November and the planning committee has begun to receive reports and suggestions as to a program for the next year.

In the election of trustees the number of trustees was increased from nine to eighteen in order to parallel the membership in each division of the electrical industry.

The original board of trustees consisted of one representative each from electrical appliance distributors, electrical manufacturers, electrical contractors, contractor-dealers, public utilities —both the Bureau of Power and Light and the Southern California Edison Co. —electrical manufacturers' agents, electrical wholesalers, electrical retailers and city downtown stores. The new board of trustees will be seen to double this representation. A. E. Hitchner, former vice-president, was named president of the league to succeed M. G. Sues who headed the first year's activity. W. E. Cranston succeeds A. L. Stone as secretary-treasurer and the new vice-president is Ross Hartley. The remainder of the board of trustees is as follows:

Appliance distributors: M. G. Sues, past president, Leo J. Meyberg Co.; H. D. Alshuler, Fey & Krause, Inc.

Contractors: A. L. Stone, former secretary-treasurer, Stone Electric Supply Co.; H. L. Evans, Nicholas Electric Co.

Dealers: J. C. Holland, Holland Electric Shop; W. L. Schlegel, Manual Arts Sales Corp.

Downtown stores: V. T. Pender, Barker Bros.; Ben Platt, The May Co.

Utilities: Burdett Moody, Bureau of Power and Light; E. V. Kane, Bureau of Power and Light; W. C. McWhinney, Southern California Edison Co. Ltd.; H. C. Rice, Southern California Edison Co. Ltd.

Manufacturers' Agents: F. J. Airey, F. J. Airey Co.; Graham Holabird, National Electrical Products Corp.

Wholesalers: F. C. Todt, General Electric Supply Corp.

The planning committee working on the 1937 program is composed of Henry C. Rice, Southern California Edison Co., chairman; E. V. Kane, Bureau of Power and Light; A. E. Hitchner; D. A. Smith and M. G. Sues. Each division of the industry was asked to consider and recommend to the planning committee a program designed to promote business during the next year. At last report plans had been submitted from the refrigeration group, the wiring group, the industrial power group, the air conditioning and air heating group and the commercial lighting group.

These programs are to be studied by the planning committee, presented to the board of trustees and financed by each of the groups with assistance from the league. Thus each group's program is an autonomous one and except where it relates to other branches of the industry will be conducted independently but under the guidance and support of the league.

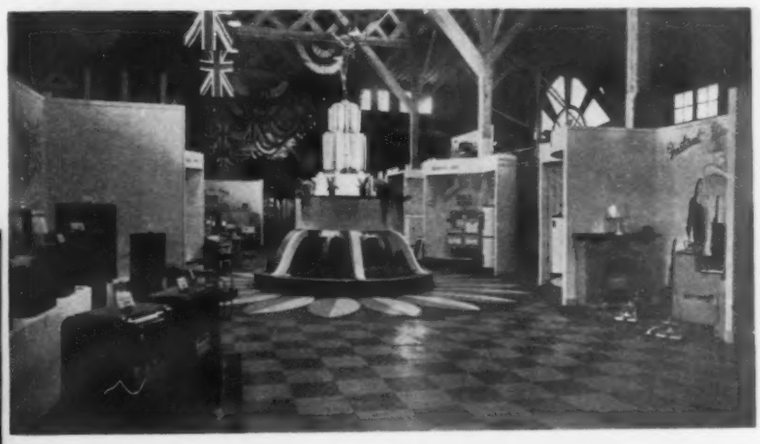
F. L. Hockensmith, general manager, announces that the programs will be sufficiently well organized to start 1937 with definite sales promotion programs in each instance.

Another active phase of the league has been the establishment of an Electrical Maintenance Engineers Assn. whose program for three months was announced recently. On Nov. 17 a dinner-meeting was held at the RKO studios for the purpose of better understanding electrical development and maintenance work in the studios. The Dec. 15 meeting is scheduled to be a gadget night which is to be a combined Christmas party and display of various gadgets available for the maintenance of electrical equipment. On Jan. 19, 1937, will be the annual meeting and election of officers which will include election of three new members of the executive committee of this association.

Christmas Lights

This is the month for outdoor holiday lighting, and cities of the West will vie for honors as to which is most cheerfully bedecked with outdoor lighted trees and homes

Exposition Display



Appliance display in the Manufacturers' Building of the Vancouver exhibition presented by the B. C. Electric Railway Co. Instead of a conventional display along one wall the exhibit occupied the center of the building and was completely enclosed, with entrances at either end. An illuminated fountain set off the center of the exhibit with appliances arranged around it

Heaters, Lamps Feature Washington Campaigns

WITH a goal of 10,000 I.E.S. Better Sight lamps the cooperative campaign which began last month in the territory of Washington Water Power Co. between dealers and the company is making substantial headway. Sales figures have not yet been compiled but individual reports from dealers and the company gave evidence of wide public response and record sales volume.

Tying in with the birthday of the I.E.S. Better Sight lamps a series of advertisements by The Washington Water Power Co. served to stimulate public interest behind which dealers and salesmen followed through for a record breaking sale of lamps. The campaign is designed for 6 months' duration and began in October.

The November advertising used a novel slant. With a general theme of "balanced diet for health—balanced light for the eyes," it brought home the necessity for sufficient light to make seeing easy and to bring freedom from glare. It has been anticipated that more than 200 dealers in the system will stock and sell I.E.S. lamps during the year. Last year 155 dealers handled them and already 193 dealers are active in the sale of these lamps.

Coincident with this campaign is one for the sale of auxiliary electric heaters. With this too the utility is doing a consistent advertising job stressing the need of quick electric heat for the bathroom and featuring both the Wesix Cent-A-Watt heater and the Thermador head-to-heels built-in bathroom heater.

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• STANDARDS—To start a movement similar to that of the American Gas Assn. in the field of electrical appliances, a standards committee has been established by the Bureau of Power and Light, Los Angeles, to make recommendations to electrical manufacturers respecting their products. Under the chairmanship of J. C. Alberts, Bureau test laboratories, the committee consists of H. M. Langlois, J. W. Rose, Alva Hall, Girard Allen or William Steube as alternate. Problems of construction, tests of the most economical method of appliance installation, suggestions for improvement of equipment are among the objectives of the committee. Through this work it is hoped the type of appliance offered to the consumers will be more highly perfected as time goes on. Letters of approval from range manufacturers for the standards committee and its purposes have been received by the Bureau.

An attractive and accessible way to display small appliances it utilized in the Fresno Appliance Co. store, Fresno. Al Kramer, manager of the store, is enthusiastic about it as a merchandising feature. Designed by J. U. Berry, of the Valley Electrical Supply Co. cooperative division, the open shelves of attractive color make appealing backgrounds for the bright, new appliances of various kinds

Appliance Dealers Pledge Code Adherence

SUCCESSFUL operation of a code of ethics which governs merchandising, advertising and installment selling and service work on radio sets and electric appliances in Vancouver was recently disrupted by a number of dealers departing from the code. The matter was discussed in detail at a special meeting of the Radio and Electric Appliance Section of the Retail Merchants' Association, where the code had been developed and administered.

In extended discussion it was revealed that any temporary advantages which might be secured by dealers departing from the code could not be continued, as if this practice of breaking the agreement was continued the situation would be thrown wide open and competitive conditions would be back to the cut-throat competition which existed prior to the establishment of the code of ethics and merchandising principles about four years ago.

Realizing that in the long run adherence to the code was by far the best policy, the radio dealers at the meeting, who represented all the prominent dealers in Vancouver and many of the smaller firms, unanimously agreed to adhere to the code in the future and in addition passed a resolution providing:

(1) That no other wording except that specified in the code, namely "generous trade-in allowance" or "liberal trade-in allowance" should be used in any advertising;

(2) That all dealers would cease advertising home demonstrations;

(3) That the standard radio service guarantee should be ninety days, and a guarantee on tubes of sixty days;

(4) That all the dealers supporting the resolution automatically agreed to acceptance of a penalty of $5.00 for each offence against the code insofar as it referred to advertising;

(5) That where such an offence occurred, the chairman should render a statement of a fine to any offenders and expect prompt settlement of such fine.

Solve Big City Buying Problem of Small Towns

More than one dealer in a small town has suffered because by habit the people in his locality drive to the nearest large city in order to make their purchase of major equipment under the impression that they save money by doing so. Electrical dealers in Tooelle, Utah, suffered from this difficulty for many years.

One day in cooperation with a dealer coordination representative of Utah Power & Light Co. they decided to analyze whether the situation really warranted doing something about it. They compared their prices with those of Salt Lake City and they were surprised to find that their own were lower in most instances. Therefore they printed dodgers which were distributed throughout the region stressing the idea "Why not Buy at Home." Each dodger was printed in a different color and told some new feature of the buy at home idea, pointing out the advantages of local purchase.

Now the district ranks highest in percentage of sales of refrigerators on the whole Utah Power & Light system.

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• AN INCREASE of 475 per cent over 1935 in electric range sales by range dealers throughout the Utah Power & Light Co. territory is being pointed to with pride for the first 9 months of 1936. Contributing success in range sales were cooking schools put on for dealers. Fine support was given such activities by dealers who capitalized on the benefits created by these schools in their district. There were 2,813 ranges sold during the first 9 months of the year or an estimated dollar value of $318,686.

Furniture Exchange Starts Spring Market Planning

COINCIDENT with the raising of foundations for its new building began the plans of the Western Furniture Exchange for its Spring Market Week in San Francisco Feb. 1-6, 1937. Improvement of business throughout all sections of the West was looked upon as indicating that the buying of home furnishings next year would exceed all previous records and that Market Week would provide dealers of the West with an opportunity for selection of merchandise stocks timed to the market.

From the electrical appliance side of it the market will include a radio and appliance show as well as a lamp and giftwares show as major attractions of the Market Week. Daily luncheons at the Palace Hotel again will feature a radio and appliance speaker and a big trade dinner one evening during the program.

Unofficial word is that one entire floor of the projected building has practically been signed up for appliance distributors with the addition of several important lines to the already long list of distributors using the Exchange. Although the building will not be finished until next July interest in the spring market will be high. It is definitely planned that the fall market will use the new building as its center of attraction.

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Commercial Cooking Salesmen Convene

Twenty-seven field men, engaged in promoting commercial cooking load for twelve Northwest utilities, met in Seattle, Nov. 19 to 21, at a conference sponsored by the Northwest Light & Power Assn. Inspection of new commercial cooking equipment, discussion of promotion problems, and visiting of new installations occupied the three-day session.

A. K. Gaylord, Portland General Electric Co., chairman of the Association's commercial and industrial sales bureau, presided. Local arrangements were handled by C. T. Bakeman, Puget Sound Power & Light Co.

The showings by manufacturers and distributors offering new equipment to the hotel and restaurant trade were a feature of this year's meeting. A part of the entire first day was allotted to each concern.

Participating were: A. F. Douglas and W. E. Johnson of the F. S. Lang Manufacturing Co., Seattle, introducing a new light range for places not requiring the heavier equipment; J. D. Sparks of the Wells Manufacturing Co., featuring the fry kettle and doughnut fryer; G. A. Lieser, Malleable Iron Range Co., showing the new Monarch semi-heavy duty range; J. Winkler and J. D. Greene of the Greene-Winkler Co., Seattle, distributing Silex coffee making equipment in the territory; J. C. Platt, L. Dickman, A. W. Patterson and H. F. Huggins of the Edison General Electric Appliance Co., each treating different phases of the company's line, and D. Y. Robinson, Montgomery Bros., Portland, explaining a method of converting old steam tables to electric operation.

Selling and promotion were discussed informally the second day at closed meetings in round table fashion under general subjects. A review of last year's program and results was led by O. C. Mayer, Idaho Power Co. Especially equipped trucks for showing equipment at the prospect's place of business were found particularly effective in small towns and rural areas.

Good and bad features of new equipment were covered in a discussion led by C. L. Jacklett, Pacific Power & Light Co. Mr. Jacklett called attention to the load building value of refrigerator-lockers for storage of meat and vege-vegetables.

Developments in kitchen ventilation were described by J. E. Yates, Pacific Power & Light Co. A. K. Gaylord told of an experiment in air heating to be conducted in Portland. The program for the coming year was outlined by C. T. Bakeman.

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• HOWELL ELECTRIC CO., Reno, Nev., recently staged an unusually successful cooking school at the Granada Theater featuring Katherine Kitchen, home economist. A General Electric model kitchen was exhibited on the stage and used by the home economist in the cooking demonstrations. The Granada Theater was practically filled to capacity every day of the school and a large number of sales were made as the result of this promotion.

Stoker Shows Sell Throughout Utah

Over 8,000 people attended the stoker show at Ogden, Utah, where 27 stokers were sold during the exhibition. A prize of 10 tons of coal to the lucky purchaser stimulated sales in connection with the show. Radio dealers also made good use of the show and reported substantial sales.

As compared with September, 1935, when 149 stokers were sold, during the same month 1936, 256 sales were made. Sixty-two radios were sold this year as compared with 37 during the corresponding month, 1935, indicating the effect of cooperative promotion upon dealer volume.

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• TULL & GIBBS, home furnishings and homewares dealers of Spokane, Wash., in presenting their "House of Tomorrow" have the distinction of opening the first completely air conditioned home in Spokane. Located at 827 Shoshone Ave. in Spokane, the home, with complete electrical equipment, contains a Kelvinator automatic summer and winter air conditioning installation. A complete electric kitchen and electrical features throughout the home attracted large crowds of visitors and clubs and organizations who toured the house during its display period.

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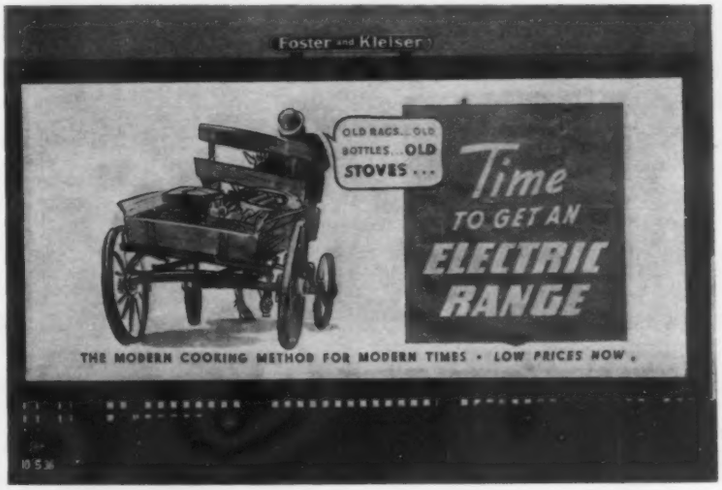
• ADVERTISING ELECTRIC RANGES as a "second step" in modernizing the kitchen, the Southern California Edison Co., Ltd., is making appeal directly to users of electric refrigerators in its cooperative advertising campaigns. The advertising is directed to bring range sales to cooperative electrical dealers.

Obsolescence Implied



A "natural" in the parlance of the advertising trade was this recent billboard of the Southern California Edison Co. used throughout its territory. The picture of the junk wagon is eloquent and emphasizes the injunction that it is "time to get an electric range"

Spokane Dealers Open as Appliance Business Grows

FOUR new electrical dealers opened for business in Spokane during the last few months. First of these, H. A. Travis, formerly with Johnson Wax Co., recently opened Travis Hardware Co. at Riverside and Lincoln in Spokane. Besides a line of general hardware, sporting goods and housewares he will have an electric appliance division.

Ken Sheridan, formerly with I. R. Johnston of Coeur d'Alene, opened a new store in the Columbia Building, handling Leonard refrigerators, American Bosch radios and other lines of appliances.

J. W. McKain coming from Washington, D. C. to Spokane opened a new electrical store at 1802 North Monroe. He will handle Frigidaires, Spartan and Grunow radios, Easy washers and table appliances. Although natives of Spokane Mr. and Mrs. McKain, who operate the store, have been away for a good many years.

J. R. Penning switched from the grocery business to electrical merchandise with a new store at Boone and Nettleton Sts. A complete line of major appliances and table cookery appliances are to be featured in this store.

At Genesee, Idaho, also was opened a new store, Mac's Radio Store, owned by L. M. Rosgen, featuring RCA and Zenith radios and Better Sight Lamps.

Lamps by the Basket

The sales crew method, the men carrying large newly painted white market baskets filled with lamps from which they made deliveries on the spot, was responsible in large part for the sensational sale of lamps last fall in the Missoula division of Montana Power Co. Sales peak of 1930 was exceeded by the white aproned lads

●

• SEARCHING FOR THE OLDEST electric washer in Portland, the Northwestern Electric Co. through its all-dealer contest last month created excellent interest in the replacement of obsolete washing machines for all the dealers of the territory. A barrage of newspaper advertising accompanied by floor and window displays announced the event to the public. Dealers were provided entry blanks for their customers and window streamers to tie into the contest. Those who entered the contest were obliged to go to the sales floor of the cooperating dealer to enter the contest and there be shown the difference between their old type of washer and the fine new models on display.

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• CITY OF BURBANK, following the example of the Bureau of Power and Light, Los Angeles, has also made arrangements for Electric Home and Farm Authority financing terms on appliance contracts. Dealers in Burbank or in surrounding communities selling to Burbank consumers may make arrangements with the Burbank utility for the financing of the paper under EHFA.

DEALER SALES REPORT—OCTOBER 1936

A Summary of Dealer Reports Compiled by Associations, Societies, Bureaus, or Dealer Contact Department of Utilities

APPLIANCE	P. G. & E. Co.[1]		San Diego Cons. G. & E. Co.[2]		San Joaquin Lt. & P. Corp.[3]		So. Calif. Edison Co., Ltd.[4]		Utah Power & Lt. Co.[5]		Wash. Water Power Co.[6]		Idaho Power Co.[7]	
	*Oct. 1936	Year to date	Oct. 1936	Year to date	Oct. 1936	Year to date	Oct. 1936	Year to date	‡Sept. 1936	Year to date	Oct. 1936	Year to date	Oct. 1936	Year to date
Ranges	377	3,459	90	500	162	1,462	658	5,441	201	2,813	136	2,052	360	3,733
Water Heaters	175	2,162	65	499	90	769	246	2,497	25	829	104	1,336	203	2,159
Air Heaters—aux.	412	5,066	100	950	75	554	371	1,239	208	811	256	1,042	81	309
Air Heaters, 220	90	727	.....	.....	79	221	.....	.....	.....	.....	.....	.....	.....	.....
Refrigerators	3,811	42,090	575	8,735	241	7,863	2,481	47,303	434	10,100	232	7,066	203	5,516
Dishwashers	10	219	.....	.....	2	18	.....	.....	.....	48	1	7	4	25
Washers	3,501	30,841	450	3,890	422	4,466	2,999	29,768	1,045	9,443	683	5,487	372	4,127
Ironers	897	8,858	105	835	64	847	538	5,801	55	467	59	586	64	481
Vac. Cleaners	2,660	22,680	275	1,865	149	1,032	987	10,066	747	5,559	287	2,099	149	1,112
Radios	9,548	79,735	1,075	9,425	[illegible]	6,000	6,722	48,330	1,864	11,175	2,379	12,438	868	5,166
Mixers	483	8,681	110	1,355	[illegible]	683	439	3,948	234	3,422	207	1,746	107	681
Cookers, Casseroles	.....	.....	60	590	12	536	111	766	34	179	279	3,531	.....	.....
Irons	.....	.....	425	3,705	459	3,933	1,771	14,672	1,463	11,958	988	7,266	464	3,757
Waffle Irons	.....	.....	175	1,715	95	1,092	713	4,526	482	4,093	302	1,951	108	1,025
Toasters	.....	.....	225	2,010	177	1,363	766	5,941	662	5,678	701	4,807	197	1,626
Table Stoves, etc.	.....	.....	85	485	112	1,094	374	2,804	1,668	12,820	110	1,558	123	1,621
Heating Pads	.....	.....	85	950	51	285	262	1,684	610	1,785	243	1,257	60	315
Curling Irons	.....	.....	.....	.....	.....	.....	73	499	348	3,082	.....	.....	.....	.....
Coffee Makers	.....	.....	165	2,005	117	1,039	389	3,492	771	4,355	570	4,207	177	1,172
Sewing Machines	1,260	12,004	30	460	.....	.....	.....	.....	126	1,368	51	653	22	143
Clocks	.....	.....	.....	.....	141	1,128	593	4,523	1,205	4,255	349	2,344	33	333
Fans	.....	.....	.....	.....	11	2,405	53	4,507	116	4,769	15	2,563	6	2,087
Floor Polishers	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sun Lamps	.....	.....	.....	.....	.....	.....	51	432	6	90	3	35	7	50
Reflector Lamps	.....	.....	.....	.....	121	1,069	.....	.....	917	7,989	1,341	6,619	.....	.....
Misc. Lamps	.....	.....	.....	.....	143	301	.....	.....	1,579	12,487	1,451	10,425	.....	.....
Yard Lights	.....	.....	.....	.....	29	463	.....	.....	.....	.....	.....	.....	.....	.....
Misc. Small Appl.	.....	.....	325	2,725	137	2,170	1,094	7,743	.....	.....	.....	.....	.....	.....
Total Dealers	1,400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. Reporting	.....	.....	.....	.....	105	120†	472	487†	.....	.....	.....	.....	.....	.....

[1] P. G. and E. reports obtained only on major appliances upon which accurate reports are available from dealers' accounts. Ranges, water heaters, and air heaters include company and dealer sales. Total dealers include gas as well as electric dealers. * Previous month's figures shown under current month's heading.

[2] Gathered by Bureau of Radio and Electric Appliances of San Diego County. Estimated monthly sales figures used in this table. Clocks, fans included under miscellaneous.

[3] Includes dealer reports from Midland Counties Public Service Corp. territory also. Compiled by Valley Electrical Supply Co.

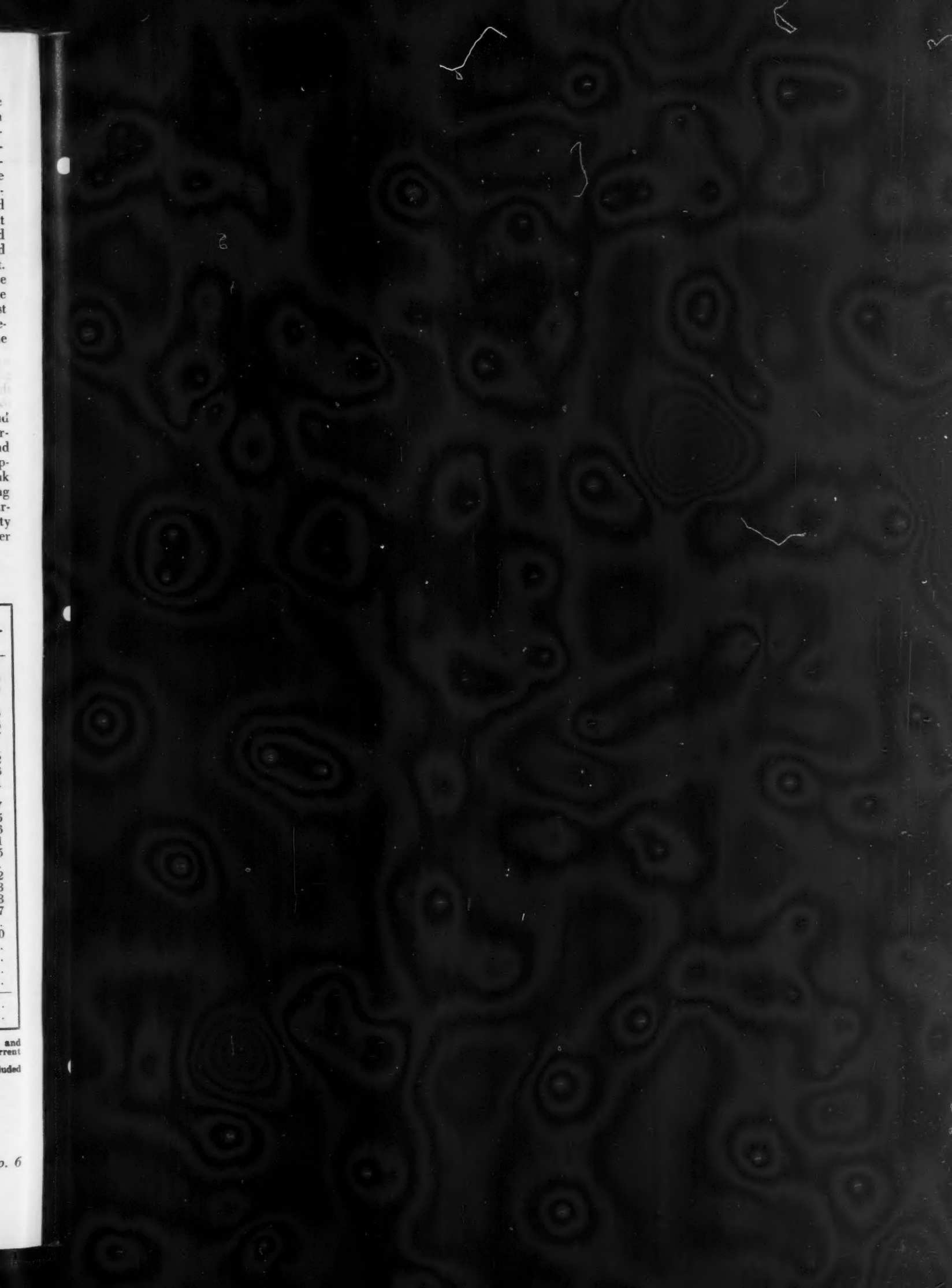
[4] Includes reports from dealers on San Joaquin Valley system of the company as well as Southern California areas served.

[5] Includes Utah Power & Light Co. territory in Utah, Idaho and Wyoming. Also Western Colorado Power Co. territory.

[6] Dealer sales only for Spokane and company's territory. Company sales not included. Table stoves, grills included with cookers.

[7] Figures compiled by Electrical Equipment Sales Association. Include power company sales and sales of all reporting dealers—about 60% report.

† Arithmetical average of number of dealers reporting. ‡October report not available at time of going to press.



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ELECTRICAL WEST COOPERATIVE

SALES APPLIANCE GUIDE

SUN LAMPS

DECEMBER, 1936

. . . . Copyright, 1936, by Electrical West, 883 Mission St., San Francisco

Profit from Winter Weather

With Sunlamps for Homes, Offices, Hospitals, Schools

THERE is opportunity for every appliance salesman or woman, every dealer in electrical appliances, whether big store, medium or small, in the sale of electric sunshine during the months of the year when nature reduces its supply of natural sunlight to these climates. In fact, because many people work and live so much indoors nowadays, there is a constant market for the sale of sunlamps, all year 'round. For salesman this means commissions and sales; for dealers it means additional sales to round out a nice appliance volume. The sunlamp is an appliance that with radio helps to balance up for the dealer his summer refrigerator sales volume.

The Market

Sunlamps can and should be sold thoroughly and carefully. But they can be sold to the following:

Every Home—Primarily for the health and well being of the *children*, but the grownups too should make use of it. *Men* who work indoors all day and neglect to get outdoor exercise, and *wives* who stay indoors too much at domestic or social duties, both need to take a diet of sunshine in order to maintain health. *Old folks* need one of these sunlamps too, especially if weather or infirmity make it difficult for them to get out of doors. *Expectant mothers* and *nursing mothers* can and should insure the strength and the health both of themselves and child by daily doses of sunshine. It keeps their own teeth from being robbed of bone-forming limes for the baby. It insures the child against rickets or "soft bone" deformities.

Offices—Both the individual stand type of sunlamp for the executive's office, or the dual-purpose lighting unit, incorporating a sunlamp with well distributed indirect general lighting, can be sold to offices and industries. The improved health of women employees of an office or of a shop where a number of women work indoors all day long will repay the management in lack of lost time and disrupted schedules of work.

Gymnasium and Swimming Pool—Every private, club or public school gymnasium should make available to its users a sunlamp. Often several can be sold, either of the ceiling, the wall bracket or the individual stand type. Swimming pools now find that it attracts patronage to provide a sun tan beach where bathers may get a sun bath between dips in the plunge.

Hospitals and Nursing Homes—Every sizeable community has several small private hospitals and nursing homes to which one or more sunlamps can be sold. For pediatric (children's) wards, for maternity homes, for rest homes for old folks or invalids, the sunlamp provides a source of sunshine that is always reliable, no matter what the outdoor weather.

Doctors and Nurses—The successful sunlamp salesman will cooperate closely with doctors and nurses in his community. Many doctors of modest means will be in the market for the popular sunlamp rather than the expensive professional models. At least they will be able to recommend to patients the purchase or rental of a sunlamp from you. Contact with these professional people will improve your understanding of just what a sunlamp will and will not do and make you more convincing in sales presentation, as well as surer of your ground.

Rental Service

Just as some dealers have found it profitable to offer customers a rental service of vacuum cleaners, washers, floor waxers, etc., there is room for one or two dealers in a large community to make a specialty of sunlamp rentals to patients of local physicians. This calls for close contact with the medical profession and special direct mail promotion. Many find that rental of such equipment leads to sales. Heat lamps too, can be featured as well as other electrical therapeutic appliances.

Advertising and Display

A dealer will find it pays to keep both his advertising and display of sunlamps on a dignified and conservative basis unless he wishes to incur the opposition and condemnation of the medical profession, which would lead to lost business and prestige. In advertisements it is best to promise no cures or panaceas. After all the sunlamp can do no more than good sunshine alone does, and that is as far as a dealer should promise. The reputable manufacturer will make available to dealers suggested ad copy that is both safe and sane. In setting up a display the pictures on this and the last page of this Guide will show what has proved the most successful idea—namely setting aside a part of the store for a sun room. Inside will be found a model sales talk which can be adapted to your prospect and which sells sunlamps without making a single claim that cannot be fulfilled amply by any good sunlamp.

Best way to display and sell sun lamps in a store is to set up a little sun room like this at Capwells, in Oakland

SALES TALKS THAT

CASE HISTORY NO. 25

Selling a SUN LAMP

WINTER TIME is sun lamp opportunity time, Bill Smith, master salesman, has found from experience. Dark days, thin sunlight at best, the need for everyone to keep up a healthy resistance to colds and other ailments so prevalent in winter, create a market that includes nearly every former customer, for the field has scarcely been scratched. Besides an attractive window and store display, suggesting summer climes and healthy tan, Bill has written to all of his customers inviting a demonstration of a sun lamp at his store. He has a lamp conveniently located and operating near the front entrance where it will get the most attention. Mrs. Hobson has just stepped in to look at the exhibit. He comes forward, greets her with a cheerful, "Good morning," when she says:

MRS. HOBSON: "Are these the sun lamps you have been advertising?"

BILL: "Yes, indeed. Rather nice to be able to have the sun at your command, bringing you the health and vigor of summer all winter long, don't you think? These sun lamps here give you full command of sunlight in your own home."

MRS. HOBSON: "They're nice, but what do the doctors say about them? There are so many health fads these days, one can't be too careful."

HERE Bill runs into a perfectly natural fear and one which he is well prepared to meet. Note how he tells just what the sun lamp does and no more.

BILL: "Health fads? I certainly agree with you, Mrs. Hobson. And if this were a mere health fad I wouldn't have it in my store. After all I'm an electrical dealer and not a physician and I certainly do not diagnose or prescribe. But by common consent with the medical profession these sun lamps are being sold, not as cures, but as a natural way to keep you healthy. They provide some of the rays of the sun which are ordinarily screened out by dull winter skies. Often a physician will prescribe sun baths, and to make it convenient for a family to take them, will recommend purchase of one of these lamps. Then your sun baths may be taken at home, more frequently, and at your own convenience. That to me, simply means that they are a recognized therapeutic method. But in selling them to anyone other than those whom the doctors send me I recommend them for their health preserving qualities—for keeping you fit, healthy, tanned and to build your body resistance and help you ward off colds and winter ills."

MRS. HOBSON: "But why use one if it isn't prescribed by a doctor?"

BILL: "Why use one unless it is prescribed? I can understand why it might seem superfluous, but you know how all of us are. We often neglect to keep up our health until a breakdown, and then spend far more in regaining it. This lamp is like health insurance, except that it keeps paying dividends every day it is used. There are four needs which our bodies must have supplied or they starve, did you know that? Good food, clear water, fresh air and abundant sunshine."

MRS. HOBSON: "I hadn't thought of sunshine in that way."

BILL: "Yes, sunshine is one of our daily needs. In summer we usually get a good deal of sunlight. But as winter comes on we bundle up in more clothes. We stay indoors more. Then, too, what sun does shine is very thin and pale —and all of its health-giving ultra-violet rays are screened

Sold APPLIANCES

out by the smoky or moist atmosphere. Yet with a sun lamp, which is designed by scientists to give just the special health bringing rays of ultra violet light, no more, you are independent of the sun. Your daily sun bath can be taken in the evening just as well as during the day."

MRS. HOBSON: "That would be a convenience. It's such a chore to get the children ready and take them down town every time they need a sun bath."

BILL: "Yes, indeed, and you and your husband too can get the benefit of this sunshine as well as your children and thus keep yourselves fit too. That is like an extra dividend from your health insurance, isn't it, for it includes the whole family? Your husband can take sun baths while shaving or you'll both find as I did that a sun bath just before going to sleep at night is wonderfully relaxing—just as you've found after a day at the beach in summer."

MRS. HOBSON: "Tell me, does it cost much to operate this sun lamp?"

HERE Mrs. Hobson changes the subject to ask the cost and Bill meets the price obstacle which comes up in almost every sale. Notice how he overbalances price with values and services that the sun lamp will give and then asks for the order.

BILL: "That's a very prudent question, Mrs. Hobson, and indicates that you are a careful housekeeper. Surprisingly, for a device that brings the health of sunlight into your home at your own convenience, and thus helps you ward off ills and colds and their attendant expenses, the fact that it operates for but the very low cost of a couple of floor lamps, makes it about the most economical health idea I know of."

MRS. HOBSON: "But how about the lamp bulb here? How long does it last?"

BILL: "That, too, is a good feature and I'm glad you brought it up. They last surprisingly long. The life of one of these lamps is rated at 400 hours which usually takes a family using one of the lamps regularly well on into the second year. Why not make a Christmas present of one to your entire family, Mrs. Hobson, a gift that will keep them, and yourself, feeling fit and well, not alone this winter but for years ahead. There's really no wearing out to one of these lamps, and they are sunlight on tap from the minute I bring it to your house. How about starting sun baths tonight, Mrs. Hobson?"

MRS. HOBSON: "What does one like this cost?"

BILL: "What does it cost? Considering, now that this lamp is really health insurance—better yet it *keeps* you healthy—and that's priceless—and that it will save you time and money in providing not only your children but you and your husband with daily sun baths at your convenience, I'm sure you will agree that the price of $..... which this one sells for is a bargain. After all it is the sunshine and the health bringing qualities of that sunlight that you are purchasing not just this lamp here."

MRS. HOBSON: "That's a good deal to pay at once."

BILL: "I know how that is too, just at this season, but let me arrange it on budget terms at so much per month. It can be yours tonight to bring you sunshine at your command. Really there is nothing I could sell you that will bring you so much personal well being as this sun lamp. I'll have it delivered this afternoon, if that is convenient."

MRS. HOBSON: "Very well, at about 4 o'clock. I hope you are right about all its fine qualities."

MRS. HOBSON puts Bill on a spot with this challenge. If he is satisfied to leave the sale here, it may turn out all right, and it may not, depending on whether she expects miracles from her sun lamp. See how Bill follows with an assurance based on reasonbale expectancy from a sun lamp.

BILL: "Thank you, Mrs. Hobson. You are showing excellent judgment. And in the use of this lamp I'm sure you will read the little card of instructions carefully and treat this lamp—or I should say yourself, just as you would under sunshine. You will not overdo it until your skin becomes accustomed to the light—just as you would do under the sun at the beach. With such easily understood operation and sun baths taken regularly throughout the winter I am sure you will find that it brings you all the health and resistance-building qualities that you can obtain from the sun itself. Moreover, I'm sure after you use it a while you'll be glad to recommend it to your friends. I expect to see you wear a good healthy summer coloring every time I meet you from now on, Mrs. Hobson."

CALIFORNIA OREGON POWER CO. • PORTLAND GENERAL ELECTRIC CO.
MOUNTAIN STATES POWER CO. • PUGET SOUND POWER & LIGHT CO.
PACIFIC POWER & LIGHT CO. • IDAHO POWER CO.
NORTHWESTERN ELECTRIC CO. • WASHINGTON WATER POWER CO.
UTAH POWER & LIGHT CO.

A large store, such as Meier & Frank, of Portland, can get excellent results from a sun room like that at the left, but any dealer can at least devote a corner like that below to sunlamps and invite his prospects to sit down and feel the effects of the sunlamp in operation

Health and Beauty

are what you sell your prospects, so tell them that a sunlamp will bring them these benefits first, then back up your statements with the features of your lamp and the reputation of the manufacturer and testimonials from those whom you have sold and are using a sunlamp.

Conserves Health—

For those who are healthy, regular sun baths during the winter season help to keep them at their best, with high resistance to colds and ills. It supplies a diet of sunshine that is missing in the out-of-doors during winter, when clouds, fog, smoke, and the position of the sun itself all tend to screen out the ultra-violet rays of sunshine which supply sunshine vitamin D to the body. This effect of sunlight is what helps the body to absorb the calcium from foods and transform it into strong bone, sound teeth and resistance to infection.

Preserve Healthy Appearance—

The sun tan acquired at the beach or out-of-doors during summer gives a healthy appearance that can be maintained by regular sunbaths with a sunlamp during winter. Indoor pallor is replaced by a glowing skin color and tone.

Easy to Take—

With a sunlamp in your own home it is easy to take sunbaths to suit your own convenience, instead of waiting for the sunshine. If it is convenient to take them at night, a flip of the switch brings instant artificial sunlight. To mothers this is a big convenience for instead of rearranging her day to suit the sun, or to take children to the doctor's or a clinic for sunbaths, they can be given at home when the children play, bathe, or do homework, or exercise. The entire family can have them at no extra expense. The alternative to sunbaths is cod liver oil, and how much more pleasant to take sunbaths!

Relaxes and Refreshes—

After the tension of a hard day a sunbath before retiring helps to relax and refresh you, makes it easy to go to sleep and forget the cares of the world.

Restores Health—

In certain types of ailment, (on doctors prescription) sunbath treatments are a definite aid in restoring health. Examples are found in hospitals, after patients have had an operation, or in the treatment of some skin infections. Expectant mothers need sunshine to help meet the demand placed upon their own bodies to supply their baby's development. Unless this can be supplied in diet and by sunbaths, minerals may be drawn from the mother's teeth and bone. This makes her teeth susceptible to decay and weakens her own general health. Children with rickets are starved of calcium and other minerals and sunbaths are definitely prescribed for the cure of this deforming ailment.

Saves Expense and Time—

Aside from the rearranging of the daily schedule to meet a definite appointment time, or waiting one's turn at a clinic, there is definitely a saving of money in taking sun treatments at home to suit one's own convenience. Office calls are reduced in number, and health is maintained besides, which again results in savings for medical care. A sunlamp lasts for years without need for repairs or maintenance, the lamps last a whole season or more, and the electricity used is less than that used by a hand iron.

Enhances the Home—

Attractive in appearance, the sunlamp is "at home" in any room in the home in which it is most convenient to use it. It can be used in the living room as a reading lamp during a sun treatment, or in the bed room to give a sunbath while reading in bed. Any home equipped with one is marked as a truly modern and up-to-date home.

A Reliable Sun—

Though no one can predict the weather, or much less guarantee it, the quality and quantity of sunlight from the sunlamp is the same measured quantity each time it is used. It makes you independent of weather, of sunshine, of time, for it is on tap whenever you flip the switch. You can depend upon the dose being just what you expect of it, which you cannot do with real sunshine because of the screening effect of fog and smoke in the atmosphere.

Heat Lamps

(Heat lamps produce high concentration of heat, or infra-red rays, which have the property of penetrating deeply into body tissues).

Relieve Pain—

In such deep seated congestions as rheumatism, neuritis, and in neuralgia, headache, strains and sprains, the heat given to the body by the penetrating infra-red rays of a heat lamp increases the flow of blood, stimulates the sweat glands to eliminate body toxins, and augments the normal blood processes and thus brings relief from the pain.

For Poultry

(Experiments conducted over a period of years have demonstrated that the farmer can obtain the following from the use of sunlamps to irradiate poultry:)

1. Increases egg production. 2. Increases the size and weight of eggs. 3. The vitamin D content of the eggs is increased. 4. The fertility and hatchability of the eggs is improved. 5. Losses from breakage of thin shelled eggs is reduced for egg shells are stronger. 6. Prevents rickets in baby chicks. 7. Accelerates the rate of growth and the weight of young pullets. (Data in support of these advantages may be obtained from the manufacturers of sunlamps.)

The Dealers' Problems—A Survey

What is the electrical dealer's principal problem?

Answer: To get salesmen that do a good sales job.

This is the response of dealers themselves to a questionnaire sent to more than 1,000 electrical retailers by ELECTRICAL WEST. The inquiry was conducted to discover the main obstacle to more retail business.

Behind this were two objectives: to reveal to retailers what a cross-section of their own membership regard as the biggest stumbling block to increased profit, and to obtain an authoritative opinion on which ELECTRICAL WEST could base its efforts to help dealers in attacking the problem.

The inquiries were sent to 1,000 dealers selected at random from ELECTRICAL WEST readership throughout the West. After careful preparation, the questions to be sent out were submitted to dealers for criticism and suggestion before being mailed. The effort was to secure a fair sample of western dealers and to present the questions so that the dealers could indicate their problems with clarity and certainty, in order to assure authenticity of the compiled results.

Here is the inquiry:

Will you number in order of importance to you, your most pressing sales problems:
To sell so that I make a profit on my present volume.
To secure increased volume from old customers.
To build business from new prospects.
To get salesmen that do a good sales job.
To meet price competition.
To build an organization that is loyal, hard working, and that builds customer good will.
To receive more sales assistance from ( ) jobbers, ( ) manufacturers.
How to get competitors to cooperate among themselves to eliminate wasteful selling practices.
To keep standard lines from going at cut prices.
Remarks.

The response is shown in Table I, in which the figures are expressed in per cent of dealers answering. For example, the upper left hand figure, 28, indicates that 28 per cent of the dealers answering ranked "to sell so that I make a profit on my present volume" as a problem of first importance.

It will be noticed that the percentages in the "first" column total more than 100. This is because many dealers ranked more than one problem of first importance. Likewise, few dealers carried their analysis as far as nine problems, so that the total of percentages in the last column is small.

In evaluating the results, two facts are outstanding: first, the extent by which the problem of getting good salesmen supersedes all others; and second, the diversity of response, even the least mentioned proposition, that of securing increased volume from old customers, being a problem of first importance to 8 per cent of those who replied.

Standing out predominantly in the list of first-importance problems are the following, ranked according to mention:

1. To get salesmen that do a good sales job
2. To sell so that I make a profit on my present volume
3. How to get competitors to cooperate among themselves to eliminate wasteful selling practices
4. To build new business from new prospects

The second and fourth questions in the above list are so fundamental that, from one point of view, all others might be regarded as means of attaining these. That is to say, making a profit on present volume and building new business might be considered to constitute the whole retail problem.

This makes the concern shown over the problem of getting good salesmen all the more significant. Selling and cooperation! It is remarkable that despite the continuous emphasis placed on these two factors in retailing, they remain the dealer's most important problems—still regarding the other two in the above list as fundamental to these.

A hint to jobbers is contained in replies to the question concerning sales assistance. Five times as many dealers found difficulty in receiving sales assistance from jobbers as they did from manufacturers. Half of those answering specified neither one nor the other.

So, with the problems hunted out, it remains to attack them. This ELECTRICAL WEST proposes to do.

Because the poll so clearly reveals that all of the problems posed have importance, all will be dealt with. Each will be taken up separately in a series of articles, the first of which will appear in the January issue.

In these discussions, the experience and suggestion of dealers are heartily sought. Perhaps you have found solutions to problems confronting others in the trade. Perhaps someone else has found the answer to your difficulty.

Your in-the-field tests, your ideas will be welcome contributions to this endeavor to improve your business.

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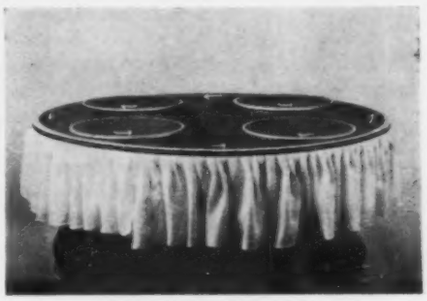
Wheels Within Wheels



Motion is a sure fire attention getter for any window display. Knowing this from much successful experience in window trimming, Fred Morrison, Grider Electric Co. of Stockton, recently built the revolving table shown in the illustration, which not only turns of itself but has four plates on it, each one of which revolves also. He has found it an excellent way to display small appliances and when not in use in his own store, rents it to other merchants in the community and thus derives a revenue from it

Table I—Returns on Dealer Inquiry

(Figures Indicate Per Cent of Total Replies)

RANK OF IMPORTANCE OF QUESTION	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth
To sell so that I make a profit on my present volume	28	8	4	8	4	0	2	2	2
To secure increased volume from old customers	8	9	11	15	6	4	6	2	2
To build new business from new prospects	19	15	11	4	5	13	6	1	0
To get salesmen that do a good sales job	36	11	7	2	4	1	0	5	2
To meet price competition	13	17	4	5	3	4	2	0	4
To build an organization that is loyal, hardworking	11	2	4	3	0	4	2	1	3
To receive more sales assistance from jobbers, manufacturers	9	6	4	5	6	4	6	5	2
How to get competitors to cooperate to eliminate wasteful selling	21	4	15	4	6	2	2	0	0
To keep standard lines from going at cut prices	13	6	11	5	9	2	2	2	4

Engineering Symposium + + +

[A monthly forum in which engineers will present and discuss their problems, this department is dedicated to advancing the art of power generation, transmission, distribution and utilization]

Lightning Arrester Experience and Performance

By PAUL B. HULL
Public Service Co. of Colorado
Denver, Colorado.

THE Denver District of the Public Service Co. of Colo. possesses several different types of interconnection of arresters and transformers, as well as several areas where low lightning arrester density has been employed. The performance or experience gained is taken up in detail further along in this report.

Weather Bureau Reports for 1935 show a total of 50 days on which thunderstorms occurred, and, for 1934, a total of 67 days. Transformer outages due to lightning were 125 in 1935 and 51 for 1934, apparently indicating that the lightning storms in 1935 were much more severe than in the preceding year.

In the following details, the reported fuse failures and transformer failures are, of course, only those due to lightning. By "Fuse Failure Only" is meant that the only item necessary to restore the transformer to service was to replace the fuse. By "Transformer Failure" is meant that it was found advisable to replace the transformer and make necessary repairs in the shop, these types of repairs including broken leads or bushings.

In the case of three-phase transformer installations, when reporting "No. in service," each installation is counted as one transformer, regardless of whether the installation consists of one three-phase unit, three single-phase transformers, or two single-phase transformers in open delta or wye.

Since interconnection was carried forward at a rather rapid rate during the lightning season, it is difficult to obtain an exact "Number in Service" on which to base percentage figures. The figures given for this item represent the average number in service for the season.

Details on the different schemes or classifications follow:

Non-Interconnected Transformers Single-Phase Installations On 2300-Volt Delta and 4-kv. Wye Systems—Rural and Urban

	No.	Percent	Average Ground Resistance
Number in Service.....	1329		
Fuse Failure Only.....	37	2.8	29 Ohms
Transformer Failure ...	8	0.6	19 Ohms

Since practically all single-phase installations within the city are interconnected, the above figures are about 90% rural and fringe installations.

Fuse Failures

In reviewing the separate reports on each fuse failure, there seems to be no relation between the ground resistance of the arrester and fuse blowing or damage to the arresters or cutouts. The average ground resistance was 29 ohms, the maximum being 300, and the minimum less than one ohm. About one-third of the cases had a ground resistance of less than eight ohms.

From tests made in previous years, we are led to believe that the average ground resistance of non-interconnected transformers is about 30 to 40 ohms. Apparently the type of arrester employed had no definite bearing on the above outages. We have in use, four different types of arresters, made by three different manufacturers, on our 4 and 2.3-kv. systems, and none show any great advantage over the others in preventing outages.

Very seldom was there any evidence of any flashing over from primary leads to the case and bushings. However, since this inspection was made from the ground, a closer inspection by opening the transformer case might have disclosed signs of flashing over.

Transformer Failures

There were eight "Transformer Failures," five of these failures consisting of lead and bushing trouble, and three having damaged coils in addition to lead and bushing damage. The average age of the failed transformers was thirteen years, and the average size, exclusive of one 150 Kva, was 7 Kva. However, these figures mean but little, unless the average age and size of all the transformers in this class are known, and, in this case, these figures are not available.

Old Style Interconnected Transformers Single-Phase Installations on 4-kv. Wye Systems, Entirely Urban

This old-style interconnection is similar to Fig. 1-A, except that the arresters are connected between the line and the fuses. For some time prior to 1922, it was the practice to interconnect transformers in this manner, but, due to conflict with the National Safety Code then in effect, the practice was discontinued in 1922. Probably this type of interconnection was employed in an effort to secure a lowered ground resistance

Engineering Reports
Rocky Mountain Electrical Association

Presented herewith are the Engineering Reports prepared for the 1935-1936 administration of the Rocky Mountain Electrical Association, the chairman and vice-chairman of which are A. H. Heitzler and L. M. Robinson of the Public Service Co. of Colorado.

The data and field experience contained in these papers should be very valuable to engineers in other companies. To the R.M.E.A., the thanks of the editors of Electrical West for making this information available to the industry.

A second installment of these reports will appear in the January issue of this publication. For convenience of the reader papers in this issue will be found as indexed below:

Lightning Arrester Performance and Experience 39
Distribution Study Produces Valuable Data 41
Standards Recommended for Distribution Grounding 44
Tests Show Precipitation Affects Footing Resistance 45
Radio Interference 46
Series Capacitor Proves Economical 48
Accident Prevention Recommendations 50
Step Regulator Solves Difficult Problem 51
Standards Urged to Prevent Current Diversion 52

ror the arrester, rather than with the interconnection principle in mind.

	No.	Percent	Average Ground Resistance
Number in Service.....	173		
Fuse Failure Only.....	1	0.58	1 Ohm
Transformer Failure ...	1	0.58	1 Ohm

Fuse Failure

On the transformer with the "Fuse Failure" only, lightning destroyed the cutout and the arrester, the leads and bushings remaining O. K.

Transformer Failure

The transformer which failed was 28 years old, the lightning burning off one primary lead, then to the case, and from the case to the secondary neutral, which was burnt off also. The coils themselves were undamaged. The transformer was protected by a General Electric compression arrester.

Standard Interconnection—Fig. 1-A 2,300-Volt, Single-Phase Installations on 4-kv. Wye Systems, Entirely Urban

	No.	Percent	Average Ground Resistance
Number in Service.....	1992		
Fuse Failure Only.....	15	0.75	1.3 Ohms
Transformer Failure ..	3	0.15	0.5 Ohms

Fuse Failure Only

In this classification, where all that was necessary to restore the transformer to service was to replace the fuse, or in some cases to replace the entire cutout, the average age of the transformer was 16 years. The average size was between 5 and 7½ kva. Arresters consisted of compression and valve type, in about equal proportions, the ground resistance, on account of the interconnection, being very low, the maximum being five ohms.

In about six of these cases, the lid of the transformer was opened for inspection, and in three of these, there was evidence that lightning had jumped from the primary leads to the case, and thence to ground by way of the secondary, doing just what the interconnection was supposed to prevent. In the other three of the six cases which had the lids opened, there was no evidence, either internally or externally, that any jumping or arcing had taken place.

In the balance of the 15 cases, or nine transformers, it was impracticable to remove the lids. On these, a rather superficial examination from the outside showed no evidence of arcing between the case and the leads, there being cutouts destroyed in two cases, however. No arresters were damaged in all of the 15 cases.

One outage occurred in an experimental area, where we are fusing the transformers for 400% of their rated capacity. No damage occurred, other than blowing of the fuse.

Transformer Failures

These were three in number, with ages of 27, 28, and 29 years respectively, indicating that age probably played in important part. The sizes were two 5's and one 10 Kva. In the older transformers, the bushings, especially on the primary side, are smaller than present practice requires; and since all three of these cases involved the flashing over from primary leads to case, these small bushings no doubt played an important part.

As before stated, in all three cases, lightning jumped from primary leads to case, from case to the secondary, and thence to ground. The damage in all three consisted of burnt-off leads, and, in one, the arrester was badly damaged. The ground resistance was not over one ohm in all cases.

General Electric Intershunt 2300-Volt, Single-Phase Transformer Installations on 4-kv. Wye Systems, Entirely Urban

Number in Service.....	9
Fuse Failure Only.....	0
Transformer Failure	0

These intershunt transformers are all located in an area of low arrester density on Feeder No. 156. Storms passing over this area, and other related data are covered more fully further on, in the section "Low Density Areas."

Westinghouse De-Ion Transformers All on Single-Phase Installations—Two in Rural Territory on 2300-volt Systems—Three in Fringe Territory on 4-kv. Wye Systems

Number in Service.....	5
Fuse Failure Only.....	0
Transformer Failure	0

Three-Phase Transformer Installations—Not Interconnected—All Three-Phase Installations on 4-kv. Wye and 2.3-kv. Delta Systems

Consisting of Both Single and Three-Phase Units Urban and Rural Included

	No.	Percent	Average Ground Resistance
Number in Service.....	525		
Fuse Failure Only.....	10	1.9	33.7 Ohms
Transformer Failure ...	2	0.4	10.0 Ohms

Fuse Failure Only

Damage in all cases consisted of a blown fuse. No damage to leads or bushings or any evidence of flashing over could be seen. However, since this inspection was usually made from the ground, this evidence might have been overlooked.

Five of the installations were in rural territory, the other five being urban. The ground resistance varied from 7 to 125 ohms, with four being less than 9 ohms. All were protected by lightning arresters of different types and makes.

Transformer Failure

One of these was a 20-kw., three-phase unit, 18 years old. Lightning

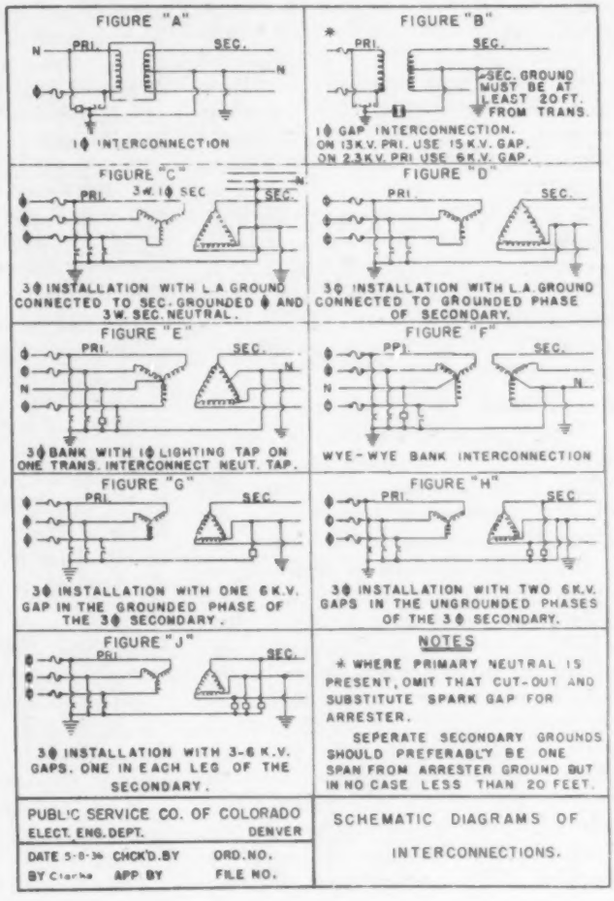


FIGURE "A"
PRI.
SEC.
N
1φ INTERCONNECTION
FIGURE "B"
PRI.
SEC.
SEC. GROUND MUST BE AT LEAST 20 FT. FROM TRANS.
1φ GAP INTERCONNECTION. ON 13 K.V. PRI. USE 15 K.V. GAP. ON 23 K.V. PRI USE 6 K.V. GAP.
FIGURE "C"
PRI.
3W. 1φ SEC
SEC.
N
3φ INSTALLATION WITH L.A. GROUND CONNECTED TO SEC. GROUNDED φ AND 3W. SEC. NEUTRAL.
FIGURE "D"
PRI.
SEC.
3φ INSTALLATION WITH L.A. GROUND CONNECTED TO GROUNDED PHASE OF SECONDARY.
FIGURE "E"
PRI.
SEC.
N
3φ BANK WITH 1φ LIGHTING TAP ON ONE TRANS. INTERCONNECT NEUT. TAP.
FIGURE "F"
PRI.
SEC.
N
WYE-WYE BANK INTERCONNECTION
FIGURE "G"
PRI.
SEC.
3φ INSTALLATION WITH ONE 6 K.V. GAP IN THE GROUNDED PHASE OF THE 3φ SECONDARY.
FIGURE "H"
PRI.
SEC.
3φ INSTALLATION WITH TWO 6 K.V. GAPS IN THE UNGROUNDED PHASES OF THE 3φ SECONDARY.
FIGURE "J"
PRI.
SEC.
3φ INSTALLATION WITH 3-6 K.V. GAPS. ONE IN EACH LEG OF THE SECONDARY.
NOTES
* WHERE PRIMARY NEUTRAL IS PRESENT, OMIT THAT CUT-OUT AND SUBSTITUTE SPARK GAP FOR ARRESTER.
SEPERATE SECONDARY GROUNDS SHOULD PREFERABLY BE ONE SPAN FROM ARRESTER GROUND BUT IN NO CASE LESS THAN 20 FEET.
PUBLIC SERVICE CO. OF COLORADO
ELECT. ENG. DEPT. DENVER
DATE 5-8-36 CHCK'D. BY ORD. NO.
BY Clarke APP. BY FILE NO.
SCHEMATIC DIAGRAMS OF INTERCONNECTIONS.

Fig. 1—Type of interconnections used by Public Service Co.

entered on the primary and jumped to the secondary leads inside the case, burning off the primary leads. There was plain evidence that the lightning jumped to the two ungrounded leads of the three-phase secondary, rather than to the middle leg, which was grounded, not only at the transformer installation, but also in the customer's premises. No damage to customers' equipment was reported. This was in urban territory, on the 4-kv. system, and an arrester ground resistance of 11 ohms.

The other failure was a 10-kw., single-phase, 31 years old, in a bank with two other 10-kva's. Leads and bushings showed no damage, but the primary coils were shorted and grounded. This was in rural territory, 2.3-kv. delta system, and arrester ground resistance of 8.5 ohms. The ages of the other two 10-kw. transformers in the bank were 20 and 23 years respectively.

Three-Phase Transformer Interconnections—Fig. 1-C, -D, and -E
All Three-Phase Installations on 4-kv. Wye Systems

Consisting of Both Single-Phase and Three-Phase Units—All Urban

	No.	Percent	Average Ground Resistance
Number in Service	157		
Fuse Failure Only	7	4.5	0.7 Ohms
Transformer Failure	0	0	

As can be seen from inspection of Fig. 1-C, -D, and -E, these are practically all the same type of interconnection, differing only in the grounded wire of the secondary side. The tying in of the single-phase secondary where present, as in Fig. 1-C, is only for the advantage of securing a lower ground resistance.

It is doubtful if interconnecting three single-phase units on a three-phase installation, as in Fig. 1-C, -D, and -E, gives true interconnection protection to one of the transformers; and, for 1936, we are trying out several installations connected as in Fig. 1-H.

Fuse Failures

These fuse outages were on a total of seven different installations, four of which were on installations consisting of three single-phase transformers, the other three being three-phase units.

On the installations of three single-phase transformers, no data are available as to which fuse or fuses blew, which might have confirmed the suspicion that true interconnection protection is not given one of the transformers in the bank. On the three-phase units, the fact that on the older three-phase transformers the bushings are entirely too small would indicate that this might be one of the reasons for fuse blowing in case of lightning troubles. The average age of these three-phase units was about sixteen years. In all seven cases, the ground resistance was one ohm or less.

Interconnection as Per Fig. 1-F — All Three-Phase Installations—All in the Business Section But One, and This Being in Heavy Residence or Apartment House Section

Number in Service	9
Fuse Failure Only	0
Transformer Failures	0

Of all three-phase interconnections, this probably gives the best protection, combining, as it does, true interconnection along with low ground resistance, because of the multiplicity of lighting customers' grounds.

Low Arrester Density Areas—Single and Three-Phase Installations on 4-kv. Wye Systems—All Urban

As of the first of the year 1935, we had three areas in Denver, operating with a reduced lightning arrester density.

First: In the business section, roughly bounded by Colfax, Broadway, Wazee, and Speer Boulevard, one three-phase arrester installation was allowed to remain in each block, all others being removed. In some instances, these arresters were located on underground terminal poles, but in most cases were placed upon either a single or three-phase transformer installation, the figures being twelve installations on terminal poles and 75 on transformer installations.

R. M. E. A. Report

Total Transformer Installations	180
Total Transformer Installations with Arresters	66
Total Transformer Installations without Arresters	114
Fuse Failures Only	1
Transformer Failures	1

Fuse Failures

The fuse failure was on a three-phase transformer, equipped with three interconnected arresters, having a ground resistance of one ohm. There were seven other transformers in this same block, all without arresters, and all connected to one phase of the three-phase feeder supplying the three-phase transformer. There is no record to show which phase it was on which the fuse or fuses of the three-phase transformer blew.

Transformer Failures

The transformer failure was one transformer of a bank of three 150 kva. The bank was protected by three non-interconnected arresters, having a ground resistance of one ohm. The coils on the transformer were so badly damaged as to require new coils or junking.

Other transformers in this or adjacent blocks served from the same feeder were not affected.

Second: A section of the city, bounded by East 13th Avenue, Cherry Creek, Lincoln, and Race Street, and served by No. 46 feeder: The scheme of reduced density employed here was to remove arresters from every other transformer, making sure, however, that the transformers at the ends of primary laterals were protected by arresters. All installations were interconnected as per Figure "A."

Total Transformer Installations	122
Total Transformer Installations with Arresters	71
Total Transformer Installations without Arresters	51
Fuse Failures Only	0
Transformer Failures	0

There were no fuse or transformer failures, although this section received its share of lightning storms passing over the city.

Third: The third part of the city having reduced arrester density was a portion of No. 156 feeder, the area being bounded by Montview Boulevard, East 32nd Avenue, Colorado Boulevard, and Monaco Boulevard.

At the start of the year, we were operating this section with practically all arresters disconnected, except those on transformer installations at the ends of primary laterals, these all being non-interconnected.

Total Transformer Installations	111
Total Transformer Installations with Arresters	67
Total Transformer Installations without Arresters	42
Fuse Failures Only	2
Transformer Failures	2

Fuse Failures

A very severe storm passed over this area on June 15th, blowing the fuse on a 5-kw. six-year-old transformer, without arresters. A transformer with self-contained arresters, two blocks south, was not affected. The other fuse failure was due to this same storm, and, in this case also, the transformer was without arrester protection. The transformer one block south had arrester protection, and the transformer one block north was without protection. Neither of these was affected. No evidence was visible from the ground, as to bushing or lead flash-over.

Transformer Failures

Of the two transformer failures, one was a 24-year-old transformer, without arresters, both failures being due to the storm of June 15th. Inspection disclosed that lightning had entered on one of the primary leads, badly burning the primary terminal blocks, passed to the core and burned off one of the secondary leads at the secondary terminal block. In this same alley, the adjacent transformer to the south, one block away, had arresters non-interconnected;

and the transformer installation one block to the north of the damaged transformer had no arrester protection. Neither of these adjacent transformers was affected by the storm.

The other transformer failure was a 5-kw., 22 years old, without arrester protection. Inspection indicated that lightning had entered on the primary neutral, jumped to the cover, then to the secondary neutral, and to ground. There is only one primary fuse on installations of this style, it being in the phase wire, the neutral being solidly tied in to the transformer. This fuse on the phase wire did not blow, but the coppered cutout on the neutral was destroyed. The damage to the transformer consisted of broken bushings and leads to be replaced. The adjacent transformers—one, one block south without arresters, and the other two blocks north with arresters non-interconnected—were not affected.

On July 18th, another storm passed over this area, but caused no outages. Shortly after August 1st, it was decided to reconnect the arresters on every other transformer installation, and interconnect. This gave

Installations with arresters	92
Installations without arresters	19

The area then went through the balance of the season without any more interruptions from lightning, although subjected probably to several storms.

13-kv. Transformers — Single-Phase and Three-Phase Installations — Non-Interconnected—All Rural—Delta System

	No.	Percent	Average Ground Resistance
Number in Service	83		
Fuse Failure Only	29	35.0	22 Ohms
Transformer Failure	6	7.2	

Fuse Failures

The fuse failures consisted usually in one or more fuses blowing, and no other apparent damage. In three cases, however, the fuse holder or cartridge itself was damaged, so as to necessitate replacement. In one case, a potential transformer on a primary metering installation was burnt out. The ground resistance varied from a minimum of less than one to 120 ohms, with an average of 22 ohms.

Transformer Failures

On the six transformer failures, the damage in every case consisted of a discharge from primary leads to the case, thence to the secondary. In some cases, this discharge was outside the transformer case, but more generally it was inside, damaging the lid, burning off leads, breaking bushings, etc. However, in none of the six cases of trouble were the coils damaged. The ground resistance varied from 5 to 125 ohms, and in one of the locations the ground had been removed entirely. All transformers were protected by arresters of various makes and types.

Fuse Failures Only

	No. In Service	Fuse Failure	Percent
Non-Interconnected, Single-Phase, 4 and 2.3-kv	1329	37	2.8
Interconnected, Single-Phase, all Types, including De-Ion and Inter-shunt—4 and 2.3-kv	2179	16	0.73
Low Density Areas (95% Single-Phase) 4-kv	413	3	0.72
Non-Interconnected, Three-Phase, 4 and 2.3-kv	525	10	1.9
Interconnected, Three-Phase Installations, 4-kv	157	7	4.46
Non-Interconnected, Single-Phase and Three-Phase, 13-kv	83	29	35.0
Total	4686	102	2.18

Transformer Failures

	No. In Service	Trans. Failure	Percent
Non-Interconnected, Single-Phase, 4 and 2.3-kv	1329	8	0.6
Interconnected, Single-Phase, all Types, including De-Ion and Inter-shunt—4 and 2.3-kv	2179	4	0.18
Low Density Areas—95% Single-Phase	413	3	0.72
Non-Interconnected, Three-Phase Installations, 4 and 2.3-kv	525	2	0.38
Interconnected, Three-Phase Installations, 4-kv	157	0	
Non-Interconnected, Single-Phase and Three-Phase, 13-kv	83	6	7.2
Total	4686	23	0.49

GENERAL

A summary of the different types of installations or the schemes employed is as follows:

Fuse and Arrester Failures

The fuse protection on fifteen installations was damaged by lightning during the season. At four of these locations, the transformer failed. Arresters were damaged at five locations.

Damaged Meters

There were thirteen d. c. and nine a. c. meters damaged by lightning during the season. Of the a. c. meters, four were listed as completely burned up, two as partially damaged, and three required new potential coils. Of the nine a. c. meters, two were on interconnected transformers and seven on non-interconnected installations.

Distribution Feeder Study Produces Valuable Data

By F. M. HOWARD
and
W. D. JOHNSTON
Mountain States Power Co.
Casper, Wyo.

MANY factors involved in overhead electric distribution are overlooked and neglected because of the fact that detailed information and analysis on distribution loads are lacking and difficult to obtain. The ordinary distribution system grows and is added to according to the demands placed upon the system by customers. In other words, we keep changing, adding to, and revamping our distribution circuits in accordance with the loads which are placed on these circuits, all of which are outside of our control. Transformer sizes are changed, transformers relocated, heavier wire installed, and voltages altered, all as a result of what naturally happens in the load district rather than what we would like to have happen or what we have originally designed the system for. The changes usually are so rapid that no distribution system can be accurately designed to fulfill the exact requirements.

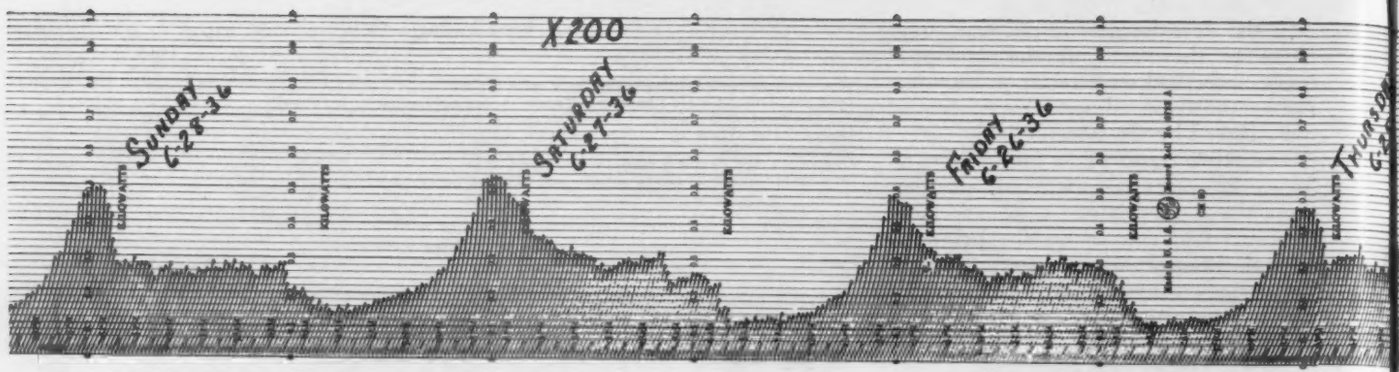
As to just what does take place in distribution circuits is usually a matter of prognostication and considerable guess work, and it is for this reason that a special investigation has been conducted on a typical distribution feeder circuit in an effort to ascertain and analyze the exact conditions prevailing. This report covers the results of such an investigation and it is thought that the information disclosed will be of interest, significance, and value to the

* Report of Overhead Systems Committee.

STATISTICAL DATA
RESIDENTIAL LOAD SURVEY—CASPER, WYOMING
As of Sept. 1, 1936

Number of Customers Served	617
Number of Families	620
Number of Residential Meters	641
Number of Commercial Meters	9
Number of Refrigerators	297
Number of Customers without Refrigerators	320
Number of Electric Ranges	31
Number of Electric Ironers	48
Number of Electrolux Gas Refrigerators (not counted in Ref. list)	8
Number of Buckeye Refrigerators	1
Number of Mayflower Refrigerators	9
Number of Crosley Refrigerators	11
Number of Servel Refrigerators	4
Number of Graybar Refrigeraotrs	3
Number of Westinghouse Refrigerators	12
Number of Leonard Refrigerators	5
Number of Norge Refrigerators	10
Number of Kelvinator Refrigerators	67
Number of General Electric Refrigerators	69
Number of Frigidaire Refrigerators	64
Number of Hibbard Refrigerators	3
Number of Montgomery Ward Refrigerators	12
Number of U. S. Refrigerators	2
Number of Majestic Refrigerators	8
Number of Grunow Refrigerators	19
Number of Water Heaters	None

As of September 1, 1936.



work of the Overhead Systems Committee. It should be of particular value as the basis of estimating transformer and distribution circuit requirements.

The method used to obtain the information was as follows. A typical residential area, embracing a total of 606 customers, of the City of Casper, Wyo., was selected, all of which was fed by one 4,000-volt primary feeder circuit. The residential area chosen was neither the poorest nor the best but represented an average residential area of the medium class, fairly well built up and with no industrial or commercial establishments of any importance. The usual corner grocery stores and scattered filling stations constituted the extent of commercial activities. Apartment houses in the district represented about the average in the smaller town, no large apartments or apartment hotels being included. The area was laid out according to the usual street and alley system, all distribution circuits being installed in alleys. Primary 4,000-volt testing and metering equipment and instruments were located on the primary feeder circuit serving the entire district. The latest type of polyphase meter with recording graphic demand attachments was used to continually record the kilowatt demands of the circuit, kilowatt-hour consumption, power factor, etc. The graphic record disclosed accurately the maximum and minimum demands of the circuit and the time of day they occurred. The customers' consumption was totalized monthly from the regular customers' meter readings. Coincident readings were taken of the primary master meter so that the difference would accurately represent all losses in distribution.

RESIDENTIAL LOAD SURVEY—CASPER, WYOMING
APARTMENT HOUSE DATA
Apartment Houses, Included in Survey Area, Having Over Two Apartments

Apartment House	Number of Apartments	Refrigerators	Ranges
A	4	1	None
B	8	4	None
C	12	12	12
D	3	None	None
E	4	2	None
F	4	1	None
G	4	2	None
H	5	None	None
J	6	2	None
K	4	4	None
L	8	2	None
M	4	4	None
N	4	1	None
O	4	3	4
P	16	None	None
TOTAL 15	90 Apts.	38	16

R. M. E. A. Report

Complete statistical data was collected on the load in this district, including installed transformer capacity, number of customers connected, the connected load of each customer, with special attention to the heavy duty appliances such as ranges and refrigerators. Much of the statistical data obtained proved of interest, especially because of the fact that it is not usually available from the ordinary records kept by electrical utilities. The results and graphic charts obtained tend to show by factual data the magnitude of losses, how they are proportioned, the relation of actual demand to installed transformer capacity, diversity of residential loads, and suggests ways and means of reduction in losses and efficient design of distribution systems.

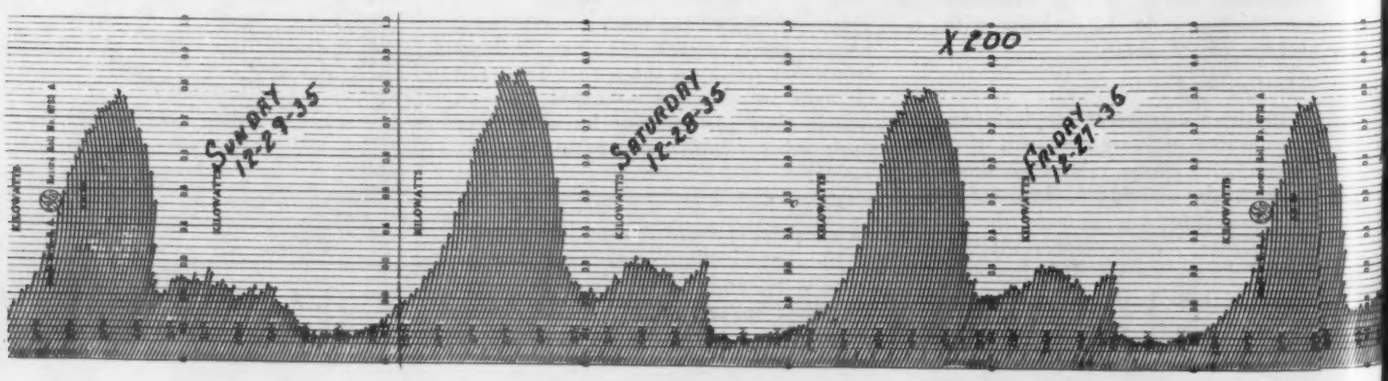
INSTALLED TRANSFORMER DATA
On Feeder

Number	Size
1	1½
6	5
5	7½
9	10
1	15
1	25
TOTAL 23	199

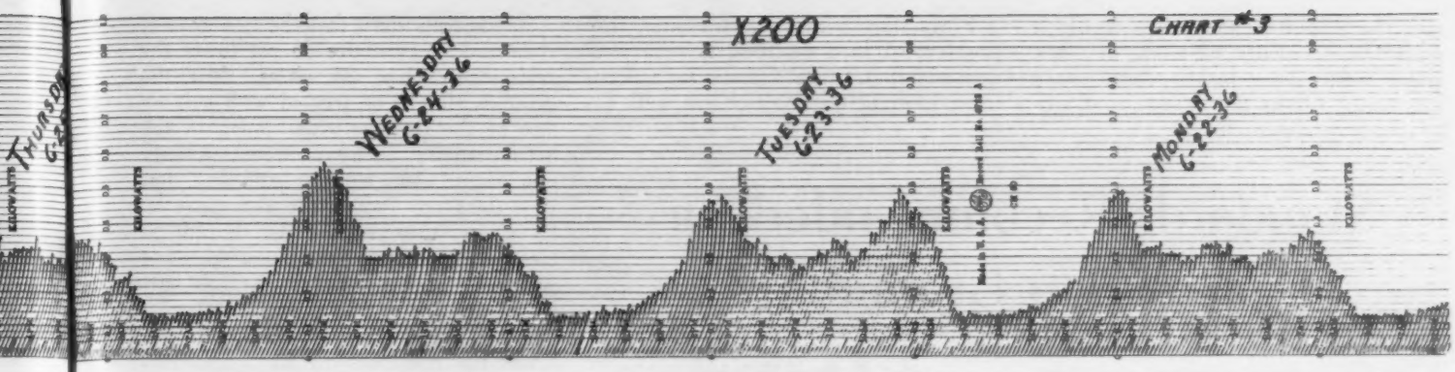
The system losses disclosed, of course could not be broken down or segregated but include all loss factors, such as primary loss, transformer core and copper loss, secondary loss, meter loss, incorrect meter registration, and current diversion.

The data covered by this report was taken over a period of six months, January 1 to June 30, which covers about half winter and half summer period. The typical graphic demand chart of the winter period can be compared with that of the summer period to observe the difference in winter and summer conditions. The investigation was designed to cover a period of one entire year but only six months were available for this report.

Mention is made of the residential rate structure prevailing generally throughout the test area, inasmuch as it has a bearing on domestic current consumption. The rate mostly used is of combination form, averaging as follows:



PRINT IN BINDING



Top—Load curve for a typical urban distribution feeder taken during a summer week

First 20 kw.-hr. per month @ 9c per kw.-hr.

Next 20 kw.-hr. per month @ 7c per kw.-hr.

Excess kw.-hr. per month @ 3½c per kw.-hr.

Tabulations are attached covering all statistical data obtained and a monthly summary of load conditions. An average of all this data has been taken covering the six months period. Two graphic demand charts are also attached, each covering a week's record, one in winter and one in summer. Other data attached discloses the saturation of electric refrigerators as well as electric ranges. It might be stated at this point that the area is completely served by an efficient natural gas system which is mostly used for heating, cooking, and water heating, thus accounting for the relatively low saturation of electric ranges and the total absence of electric water heaters.

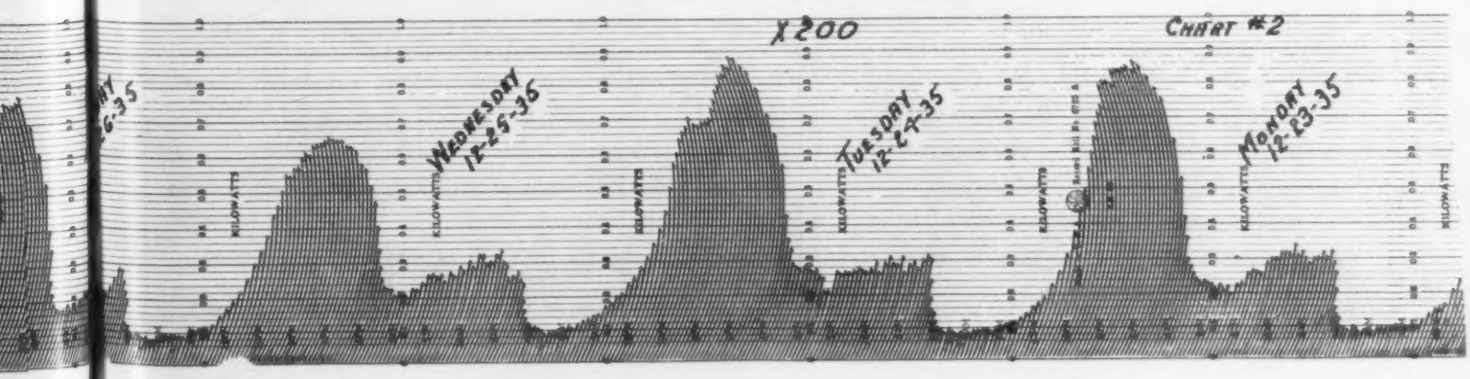
A summary of the more interesting results revealed by the test is as follows:

1. The average consumption per customer of 58.7 kw.-hr. per mo.
2. Total distribution losses averaging 12.65 per cent.
3. Average load factor 31.8 per cent.
4. Average power factor over a 24-hour period from 82.5 to 84.2 per cent.
5. Average maximum demand on the system of 179 kva. as compared with the total installed transformer capacity of 199 kva., which represents that 90 per cent of the installed transformer capacity was being utilized over a fifteen-minute demand period.
6. An average kva. demand per customer of .295.
7. An average kw. demand per customer of .248.
8. An extreme variation in kw. demand from 15.6 kw. minimum to 151 kw. maximum, showing that the minimum demand was approximately 10 per cent of the maximum.
9. The graphic charts clearly show the variation in 24-hour load. The evening peak load is strongly emphasized in its relation to the off-peak load; in other words the hills and valleys are very pronounced, demonstrating the great field open to current consuming devices using off-peak power. A comparison of the summer chart with the winter clearly demonstrates the effect of refrigeration and air conditioning on load factor, the differential between maximum and minimum demands over a 24-hour period being much less in summer than in winter. It furthermore shows the possibilities and desirability of adding further summer refrigeration and air conditioning load, much of which could be added without raising the summer peaks beyond the winter peaks, yet at the same time materially filling up the valleys in the summer load chart. The most valuable winter

Residential Load Check Data — Mountain States Power Company, Wyoming Division

Date 1936	No. of Weeks	Check Meter Consum. KWH	Cus. Consum. KWH	Loss KWH	% Loss	No. of Cus.	Avg. KWH Cus. 30 Days	Demand KW 15 Min. Max.	Demand KW 15 Min. Min.	KVA	Avg. Load Fac. %	Installl. Trans. KVA	% KVA Demand of KVA Inst.	Power Factor in %	Avg. KW Dem. per Cus.	Avg. KVA Dem. per Cus.
Jan. 6 to Feb. 3	4	42,800	37,236	5,564	13.0	616	64.8	168	14	199	33.1	199	100.0	10 AM 82.0 7 PM 84.4	.273	.323
Feb. 3 to Mar. 9	5	50,600	43,629	6,971	13.7	617	60.6	172	16	202	30.5	199	101.5	10 AM 82.6 7 PM 85.	.279	.328
Mar. 9 to Apr. 6	4	37,200	33,456	3,844	10.3	618	58.1	158	16	190	31.5	199	95.5	10 AM 83.1 7:30 PM 83.0	.256	.308
April 6 to May 4	4	35,200	31,049	4,151	11.8	607	54.8	146	16	172	31.7	199	86.5	10 AM 81.9 8 PM 85.0	.241	.283
May 4 to June 8	5	42,000	36,446	5,554	13.2	592	53.0	126	16	149	29.0	199	75.0	10 AM 82.1 8 PM 84.7	.213	.252
June 8 to July 6	4	36,800	31,800	5,000	13.5	591	57.6	136	16	163	34.7	199	82.0	10 AM 83.5 8 PM 83.0	.230	.276
Average		40,766	35,602	5,164	12.65	606	58.7	151	15.6	179	31.8	199	90.0	10 AM 82.5 7-8 PM 84.2	.248	.295

Below—Load curve on the same feeder as shown on the top of the page, taken during a typical winter week



load that could be added is that which would be decidedly off-peak, in other words, would not raise the winter peaks but would fill in the exaggerated valleys in the winter curve.

From the foregoing statistics, the problem of load building is very well demonstrated. The factors to concentrate upon in this respect are well defined.

Standards Recommended for Distribution Grounding*

By R. A. HAMMACK
Public Service Co. of Colorado
Denver, Colo.

DUE to the importance of having adequate grounds on lightning arresters, distribution secondary, transformer cases, etc., the following suggestions and notes are offered, with the thought of establishing some standard method and minimum requirements for such grounds.

With interconnection of distribution transformers, the necessity for adequate grounds becomes more and more important, not so much from the standpoint of protection to the transformer, but to avoid damage to the customer's wiring and equipment.

All driven ground rods, or other artificial grounds not interconnected to a water piping system, should have a resistance not in excess of 25 ohms.

Tests should be made on new grounds of this type, when installed, and a program should be instituted for checking old grounds as conditions permit. One of the following methods should be used for lowering the resistance of all such grounds having a resistance of more than 25 ohms.

a. Drive another rod at least 6 feet distant from the first rod, and tie the two together with No. 4 bare copper buried about 10 to 12 inches below the ground surface. If it is not possible to drive this second ground rod, it may be omitted and the first one treated with salt. However, the second ground rod is very desirable if it can be installed.

b. If tests show that the two ground rods under (a) above do not lower the resistance below 25 ohms, then the grounds should be treated with salt by one of the two methods shown in the accompanying sketches. Treating only one of the rods may be sufficient, but if it does not reduce the resistance to 25 ohms, then both rods should be treated. Experience, tests, and the good judgment of the man on the job will be a guide as to this.

c. If the above two methods do not lower the resistance to 25 ohms, then a third ground rod should be driven not less than 6 feet from the other two, and treated.

d. In some cases, such as in solid rock or rock piles, the above methods will not be practical, and it may be necessary to run some distance to a swamp, creek, well casing, etc., or to better earth conditions. Such runs should be made with a No. 2 or No. 1 bare copper wire, buried at least one foot deep and deeper if possible. If the ground is made in a stream, driven rods should be used, as it is not good practice to depend on a coil of wire thrown into the stream or buried to a shallow depth in the stream bed. If the ground is run to a swamp or better earth conditions, then the methods outlined under

Fig. 1—Soil treatment for improving grounds

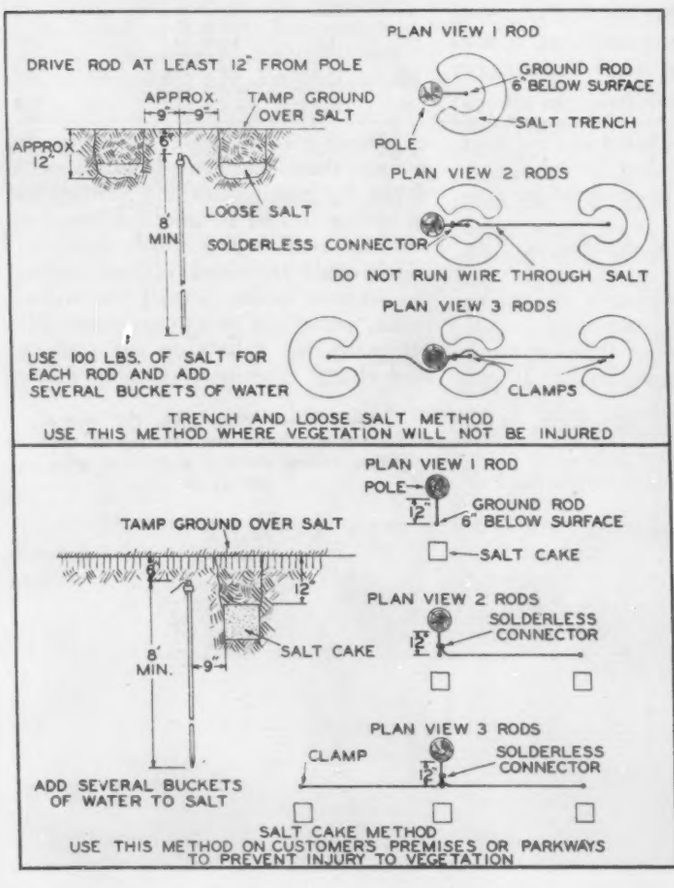
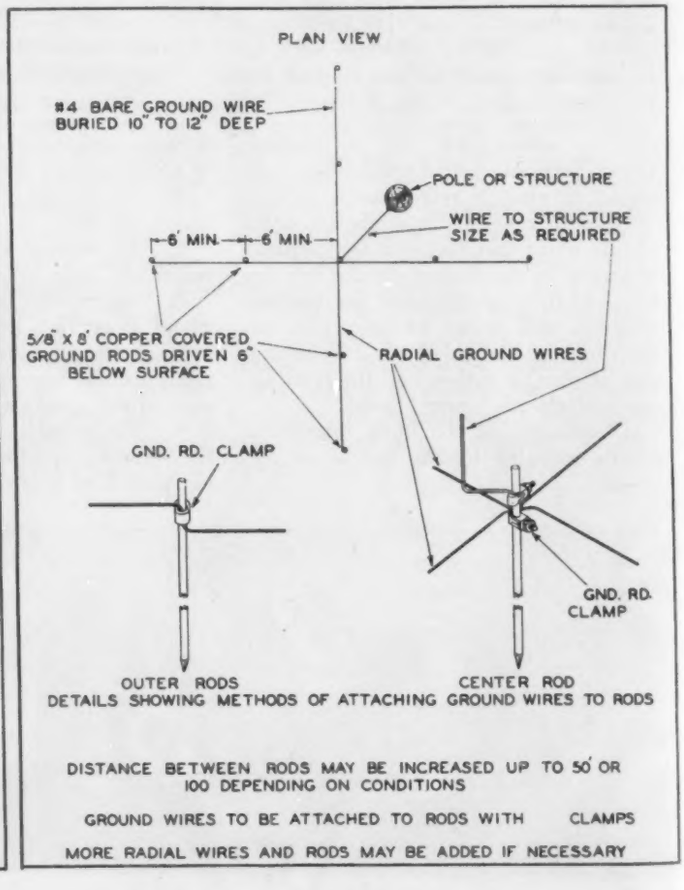


Fig. 2—Radial grounding system


PLAN VIEW
#4 BARE GROUND WIRE BURIED 10" TO 12" DEEP
POLE OR STRUCTURE
WIRE TO STRUCTURE SIZE AS REQUIRED
6' MIN.
6' MIN.
5/8" X 8' COPPER COVERED GROUND RODS DRIVEN 6" BELOW SURFACE
RADIAL GROUND WIRES
GND. RD. CLAMP
GND. RD. CLAMP
OUTER RODS
CENTER ROD
DETAILS SHOWING METHODS OF ATTACHING GROUND WIRES TO RODS
DISTANCE BETWEEN RODS MAY BE INCREASED UP TO 50' OR 100 DEPENDING ON CONDITIONS
GROUND WIRES TO BE ATTACHED TO RODS WITH CLAMPS
MORE RADIAL WIRES AND RODS MAY BE ADDED IF NECESSARY

(a), (b), and (c) above may be followed until the desired ground is attained.

e. Another more elaborate method which has proved very good, and which is applicable to the more important grounds, such as substations, capacitor installations, etc., is the buried radial grounding system shown in drawing No. 2. The rods attached to the buried radial wires should not be less than 6 feet apart, and may spread up to 50 or 100 feet, depending on conditions. With this method, salting probably will not be necessary.

Salt treatment is only a temporary means of improving grounds, and where it is used, the grounds should be rechecked about every four years and, if necessary, retreated. After a salt treatment has been made and watered, it is necessary to wait a few days before testing, in order to give the salt time to permeate the earth.

Some other suggestions as to the installation of grounds follow:

1. All driven grounds should consist of 5/8 in. x 8' 0 in. copper-covered steel rods.

2. Rods should be driven at least 12 inches from the pole, but if this is not practical due to pavement or other reason, then the rod should be driven at a slight angle so that the lower end of the rod gets away from the pole.

3. Ground wires should be attached to the rods with suitable clamps, and the clamp and top of the rod should be buried about 6 in. beneath the surface of the earth.

4. The ground rod should be so placed that the ground wire running from the pole to the rod is least likely to be dug into or broken from other cause.

Where it is necessary to use a salt treatment at a ground on a customer's premises, such as a driven ground for an outdoor meter box, the salt cake method only should be used, and the cake should be buried so that there is at least one foot of earth above it. The trench method and loose salt should not be used because of the possibility of injury to vegetation.

Lightning Arrester Grounds

"For lightning arresters, the grounding conductor or conductors shall have a current capacity sufficient to insure continuity and continued effectiveness of the ground connection under conditions of excess current caused by or following discharge of the arrester. No individual grounding conductor shall have less conductance than a No. 6 copper wire." National Electrical Safety Code—Section 9, Rule 93-b.

It is general practice to use No. 4 T. B. W. P. wire for all arrester grounds, except for installations of large capacity which, under the rule in the above paragraph, require a larger ground wire.

Secondary Neutral Grounds

"The grounding conductor for alternating-current systems shall have a current capacity not less than one-fifth that of the conductor to which it is attached, except that it need not be larger than No. 0 copper." National Electrical Safety Code—Section 9, Rule 93-b.

It is common practice to use No. 4 T. B. W. P. wire in general for grounding secondary neutrals at the pole, and this is no doubt, adequate for any ordinary secondary.

Substation Grounds

"The grounding conductor for alternating-current systems shall have a current capacity not less than one-fifth that of the conductor to which it is attached, except that it need not be larger than No. 0.

"For non-current-carrying parts of electrical equipment, the conductance of a grounding conductor shall be not less than that provided by a copper wire of the size indicated in the following table. When there is no fuse or automatic circuit breaker protecting the equipment, the size of the grounding conductor will be determined by the design and operating conditions of the circuit.". National Electrical Safety Code—Section 9, Rule 93-b.

Rating of Fuse or Circuit Breaker Which Protects Equipment or Conductors	Size of Grounding Wire
Not more than 100 amperes	10
More than 100, but not more than 200 amperes	6
More than 200, but not more than 500 amperes	4
More than 500 amperes	2

From the National Electrical Safety Code—Section 9, Rule 93-b.

Further information and details are shown in the sketches and drawings accompanying this article.

Test Shows Precipitation Affects Tower Footing Resistance

By L. M. ROBERTSON
Public Service Co. of Colorado
Denver, Colorado.

DURING recent years of subnormal precipitation it had been noted that there was a greater proportion of three phase and two phase to ground faults than was normally experienced on a 100 Kv. steel tower transmission line of the Public Service Company of Colorado. In the case of lightning strokes a higher percentage of faults had been one phase to ground.

In view of the fact that a multi-phase fault is very severe, and also because the installation of a Petersen coil was being considered to eliminate line outages in case of one phase to ground faults, an investigation was made to determine the possible causes of this condition. Tests of tower footing resistances were made in 1934 and 1935, on towers of this line where the altitude ranges from 6,000 to 13,000 ft. Some interesting data were obtained and the probable cause of the trouble was discovered.

Fig. 1 shows the resistance of the tower footings for the two years for various locations at altitudes in the above mentioned range. It was found that the resistance in 1934 was much higher than in 1935. A study of records of yearly precipitation from 1930 to 1935, showed that the year 1934 was the end of a long period of deficiency of precipitation, as illustrated in table "B", whereas the year 1935 indicated an excess of precipitation. Therefore,

Fig. 1—Tower footing resistance for wet and dry year at various altitudes.

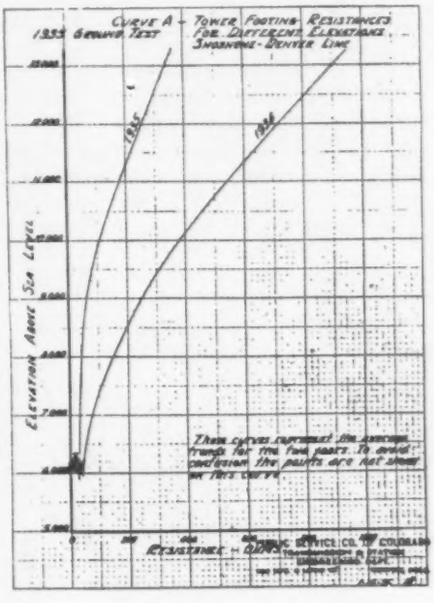

Curve A - Tower Footing Resistances For Different Elevations - Shawnee-Denver Line
1935 Actual Test
1935
1934
Elevation Above Sea Level
Resistance - Ohms
Public Service Co. of Colorado

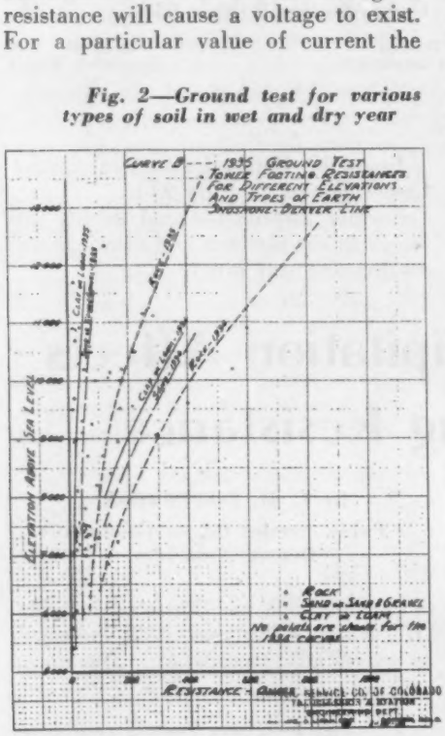
Table B—Yearly Precipitation for 1930-1935

Year	Inches Precipitation	Inches Deficiency (14.05 In. Average)
1930	9.12	4.93
1931	13.16	0.89
1932	10.12	3.93
1933	12.07	1.98
1934	8.93	5.12
1935	17.12	3.07 (Excess)

it appears that in dry years the footing resistance is higher, and that the higher the altitude the greater is the value of the resistance.

Fig. 2 shows similar curves for the various types of earth in which the towers were set, such as rock, gravel, clay, etc. The importance of this resistance may be seen when it is remembered that a flow of current through a resistance will cause a voltage to exist. For a particular value of current the

Fig. 2—Ground test for various types of soil in wet and dry year



voltage will be in proportion to the resistance. Therefore, when a tower is struck by lightning a certain amount of current will flow depending upon the nature of the stroke, etc. If the resistance of the tower footing is high a correspondingly high voltage will appear on the tower top which may cause insulator flashover, depending upon the amount of insulation. If the potential of the tower top should rise sufficiently high it would be possible for more than one phase to flash over. Therefore, with a very large increase in tower footing resistance, it appears that the tower top voltage might be sufficient to cause more than one phase to flash over.

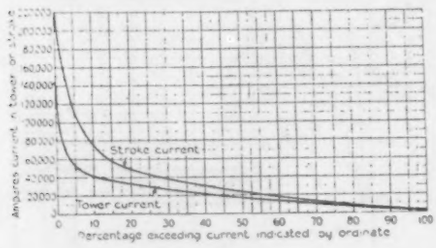


Fig. 3 — Cumulative curve of tower and stroke currents from surge crest ammeter records

Values of tower current and stroke current have been collected from readings taken from a large number of surge-crest-ammeters which have been placed on towers at low altitudes. This information has been compiled by the General Electric Company, and indicated in Fig. 3. This will give one an idea of the values of current which may be expected at the lower altitudes.

Also, information has been collected by a number of power companies on impulse currents passing through distribution lightning arresters. It, therefore, appears that tower currents of 140,000 amp. and below may be expected and up to 15,000 amp. may be expected in distribution arresters. It is possible that earth resistances may reach high values, due to lack of moisture in the ground, and the presence of surge currents may produce very high voltages. It is obviously quite important that consideration be given to the condition of grounds and ground connections to keep the resistance as low as feasible so that high potentials will not appear to endanger life, equipment and continuity of service.

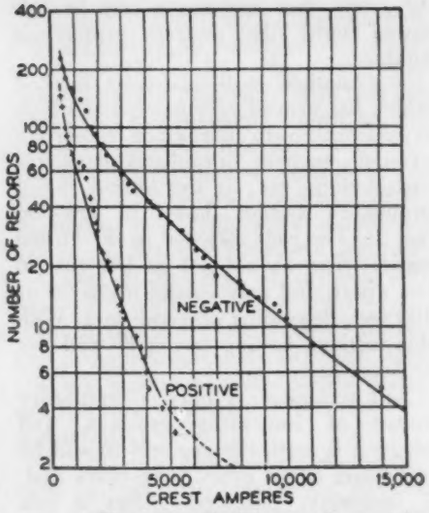


Fig. 4 — Positive and negative currents in distribution lighting arrestors

Radio Interference

By J. M. WISSENBACH
Public Service Co. of Colorado

IN 1935 the estimated number of radio receivers in the United States was 18,672,200. Based on the 1930 census, this is one receiver for every 1.6 families in the country. This is exclusive of commercial, government, amateur and aircraft. An industry that affects the daily lives of so many people and represents a large financial investment is deserving of every effort and consideration by the other industries.

Radio transmission and reception are interfered with by many different kinds of so-called static. Many originate in nature; others are produced by man-made equipment.

Overhead transmission lines of the pin-type construction are potential sources of radio interference. The following list contains a number of constituent parts of transmission lines and some of the electrically-connected equipment that is frequently the cause of radio interference:

Insulators	Fuses
Line conductors	Lightning arresters
Hardware	Switches

The most important of these possible sources of interference are insulators, conductors, tie wire and hardware because they are distributed throughout the entire length of the line. When they are the cause of abrupt electrical discharges which are so effective in producing high-frequency oscillations, the resulting interfering radiation is very serious.

Radio Interference from Insulators

Radio interference from high-voltage insulators is coincident with and due to ionization of the air or corona formation in regions of excessive voltage gradient. It is also well known that these regions of excessive voltage gradient usually occur on conventional designed pin-type insulators at the following locations:

(1) At points where the conductor and tie wire are not in intimate contact with the head of the insulator.

(2) At the junction between the pin or thimble and insulator material or cement.

(3) Between shells of multi-part insulators.

The elimination of radio interference due to corona formation on high-voltage insulators is a dual problem:

(1) Improvement in the design of new insulators for future installations.

(2) The treatment of insulators now in service.

The treatment of insulators in service at the present time is as follows: A conduction paint made commercially is applied to the head of the insulator and tie wires. This paint has been in service by a utility company in the northwest for about three years, with no apparent deterioration. The manufacturer of this paint would prefer to have its use looked upon as a maintenance operation, with the realization that it may be necessary to go back over the insulators within two or three years and apply another treatment of paint.

Radio Interference from Line Conductors

Transmission lines are sometimes designed to use small conductors as a matter of economy and, therefore, they are operated very near the corona range. A considerable amount of corona may form on these closely-designed conductors at normal operating voltage, on account of conductor irregularities formed by abrasions received during construction, or because of surface contamination of various kinds, including the results of weathering. Conductor corona in any amount produces some radio interference.

Radio Interference from Tie Wires

The radio interference caused by corona formation on sharp projecting ends of tie wires on pin-type insulators may be eliminated in most instances by cutting the tie wires off close and bending them in snug against the conductor. When hot sticks are used and sometimes for other reasons it is impractical to cut the tie wire off close to the conductor. This condition can be met by cutting the tie wire to the proper length, and shielding the ends by bending them in the form of closed circular loops approximately one inch in diameter.

Insulated tie wires on bare or insulated conductors, and bare ties on insulated conductors should never be used on lines of 11 kv. and over. Vibration will cause the insulation to wear through on either the tie wire or conductor, and a discharge will take place. When insulated conductors are used the insulation over the head and for three to four inches either side of the insulator should be removed and bare ties used.

Radio Interference from Hardware

The radio interference from high-voltage line hardware is usually produced by small electrical discharges between insulated conducting parts, or by intermittent mechanical contacts between metallic parts in the dielectric field of the line conductors. The difference in potential between insulated metallic objects in the dielectric field is frequently quite high and will produce serious radio interference. Interference of this type from line hardware can be eliminated by using lock washers on all bolts and screws, and giving particular attention to the placement of hardware in construction practice. Bonding of hardware should be avoided in all possible instances, and when used it should be considered only as a last resort.

Radio Interference from Distribution Systems

Distribution systems are subject to some of the same potential sources of radio interference as found on high-voltage lines, which are as follows:

Hardware	Lightning arresters
Switches	Fuses

While the above covers the most common potential sources of radio interference, there are some unusual cases that the individual investigator will encounter.

R. M. E. A. Report

Transformers are sometimes included as possible sources of interference. I do not include them as a common source of interference as, from a continued inspection over a period of three years, we have found that less than one per cent are causing radio interference. In all cases, the trouble was due to a poor electrical bond between the core and case, resulting in a static discharge. This condition was found only in the older type transformers.

In very many cases distribution systems are accused of creating interference which is produced by private equipment. The private equipment that is probably the extreme in producing radio interference is the diathermy machine. This machine has an output of five amperes of radio frequency current and will blanket radio reception over an area of approximately twenty city blocks.

Locating Radio Interference

It is possible to determine the general source of radio interference by the audible sounds reproduced by the loud speaker. The investigator can classify them under the two following heads:

(1) Those which originate on power systems.

(2) Those which originate on customer equipment.

In most cases, the radio interference originating on power systems will produce a distinct buzzing sound and very definite peaks will be found at some frequencies. These peaks will not, in all cases, be multiples but may appear at odd frequencies. The investigator should, in all complaints, hear the interference on the customer's receiver and note the frequency at which the maximum intensity is obtained. If possible, this same frequency should be used in locating the radio interference. In case the interference cannot be picked up or is not maximum at this frequency, the investigator should determine and use that frequency which will give maximum intensity. This method is very nearly perfect if the presence of ground wires, loops, and series street lighting circuits are considered when the point of maximum intensity is found.

It may be of interest to cite a case or two using the above method.

The first case will deal with interference on a 13-kv., three-phase, delta-connected system. The interference was present over about three miles of line, and the maximum intensity was found at 2,400 kilocycles. With the loop set at right angle to the line, a very decided increase in volume was noted when passing one particular pole. A close inspection of the line at this pole disclosed insulated tie wires. The line conductors were medium hard-drawn bare copper wire. These tie wires were removed, and a number of holes were found in the insulation. The copper of the line and the tie wires were pitted, which was absolute proof a discharge occurred at these points. Also, there is a possibility, if this condition was to remain for some time, it would weaken the line conductors and might, under heavy loading conditions, result in an outage.

The second case will deal with interference on a single-phase, 2.3-kv., distribution system. In this case, it was possible to pick up the interference over a large area, due to a series street lighting circuit traversing this territory. A number of intensity readings were obtained, and the maximum intensity was found to be at a transformer installation. To eliminate any false indication due to the lightning arrester ground wire at this point, the transformer installations on either side were checked and the noise was found to be considerably less in volume. Inspection disclosed a crossarm brace one-sixteenth of an inch from the dead-end bracket, which resulted in a discharge between bracket and brace. Here again, a definite frequency was used, which was about 1,100 kilocycles.

Radio Interference Originating on Customer Equipment

In a large percentage of cases, the radio interference originating on cus-

tomer equipment can be classified by the sound reproduced by the loud speaker. A very intense fry or hiss has three possible sources: A diathermy machine, the violet ray, and neon signs. The X-ray can be included in this group, but in most cases the X-ray is operated at very short intervals and is not objectionable.

Motors and rotating equipment will produce a popping or rasping sound in a definite cycle, and direct radiation is limited to less than twenty-five feet. The distance this type of interference will feed back over the line will be limited by the current drawn by the particular piece of equipment.

Heating units and flashing signs will produce a short intermittent buzz. In some cases a definite time cycle will be present. Direct radiation is very limited, and feed-back over the line is about a block or two. The intensity method is used for locating radio interference from customer equipment. In some cases a directional loop can be used to good advantage.

Equipment for Locating Radio Interference

It is not my intention to recommend any special type of equipment for locating radio interference, but rather give a description of our present equipment. The equipment used in Denver is installed in two automobiles. One consists of a seven-tube, all-wave, superhetrodyne, battery-operated receiver, coupled to a closed tuned loop, mounted on the roof of the car in such a manner that it may be rotated and lowered flat against the top when not in use. The receiver covers the frequencies from 800 to 20,000 kilocycles, using plug-in coils for six different bands. An output meter is included, but is not calibrated for any value. A dynamic speaker or phones is used for audible output.

The other car is equipped with a standard auto receiver covering the broadcast frequencies. The receiver has the automatic volume control removed and a gain control substituted. Switching is arranged so the plate supply may be from batteries or the regular vibrator and rectifier. The loop is of the same design as the one described above. An output meter and speaker are also included.

The districts outside of Denver are supplied with five-tube, tuned radio frequency, portable receivers, which are battery-operated and self-contained, and are also equipped with a collapsible seven-foot antenna. We constructed these portable receivers from standard parts, at an average cost of $80.00. These receivers will take care of the average complaints, and when more sensitive equipment is required, the car in Denver is available.

Complaint Handling

In conclusion, it may be well to outline our method of handling radio interference complaints. When a complaint is received, the customer is contacted to determine if the interference is in the radio receiver or is from an outside source. If not in the receiver, it is explained to the customer that some time may be required to locate the interference. We assure the customer that after our investigation the trouble will be corrected, or if it is beyond our control the location and cause of the interference will be explained. In a case where the interference is caused by our lines, we admit the responsibility, but do not go into detail as to the source. This will help to prevent the public from selecting some particular piece of our equipment to hold responsible for all sources of radio interference.

One example should clear up any doubt as to the wisdom of the above statement. Some time ago, a number of transformers were changed to correct radio interference. In a few instances this was actually the cause, and as a result, the public associated all radio interference with transformers. At the present time one-third of the complaining public will stress the point that a transformer located in close proximity to their residence is the cause of the radio interference.

In the year of 1935, we investigated 280 complaints, classified as follows:

Customer Radio Receiver	22
Customer Appliance	101
Public Service Company of Colorado	47
Other Utilities	21
No Trouble Present	42
Too Intermittent to Locate	47
Total	280

Series Capacitor Proves Economical

By ARNOLD E. PERRETEN
Public Service Co. of Colorado

ABOUT a year ago, the Public Service Company of Colorado was presented with the problem of supplying either a 750 or a 500-hp. fan motor at the East Portal of the Moffat railroad tunnel. This motor operates intermittently, with twenty or more starting operations per day. This customer is supplied over a 13,800-volt, No. 2 copper line, 22 miles long, from the Boulder Hydro Plant. In addition to this motor, the line was to supply 500 hp. miscellaneous power at the tunnel and 200 hp. in the vicinity of Nederland, or a total of 1,450 hp. on the line. (This load has since been increased to 1,650 hp.—the peak load during the test May 8, 1936.) The problem was to obtain a voltage regulation (full load to no load) not to exceed 10 per cent at East Portal, and a maximum flicker of 3 per cent at Nederland where most of the lighting customers are served.

Three plans to supply this load were considered:

(1) Change the line voltage to 44-kv., at an estimated cost of $43,130.

(2) Change the No. 2 copper conductor to No. 2/0 copper from the Hydro Plant to Nederland, to reduce the motor starting flicker, and install a step voltage regulator at the plant, to maintain the voltage level within operating limits. Cost $16,240.

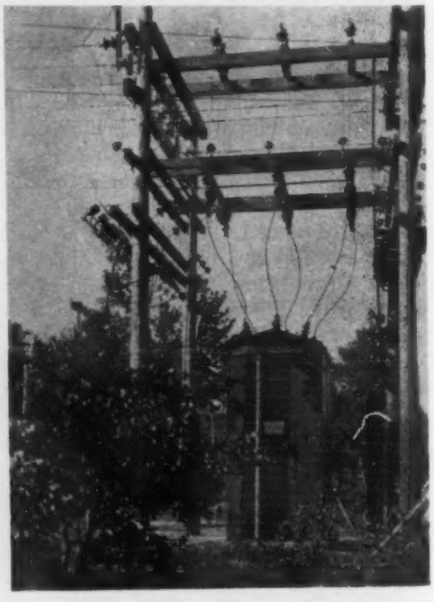
(3) Install a series capacitor at Nederland. Cost $7,500.

Plan No. 1 would result in a voltage regulation considerably below the requirements at a cost nearly six times that of Plan No. 3, and could not be justified for the load contemplated.

Plan No. 2 was the minimum reinforcement that could be considered, and would result in a flicker of 3.4 per cent at Nederland when the 750-hp. motor is started, and 2.5 per cent when the 500-hp. motor is started. This was considered satisfactory because the 750-hp. unit is to operate only when the 500-hp. unit breaks down.

Plan No. 3—the series capacitor—

Fig. 1—Series capacitor installation on Moffat tunnel transmission line



was designed to give a net rise of 2 volts at Nederland on the 750-hp. motor starting current, and approximately 10 per cent over all regulation (full load to no load) at East Portal.

Plan No. 3 was chosen because it promised satisfactory results at a cost of less than half that of any other satisfactory reinforcement.

This capacitor as constructed for the Public Service Company of Colorado is rated at 270 kva., 3-phase, 60-cycle, 75-amp., 1,200-volt, for installation on a circuit at 13,800 volts.

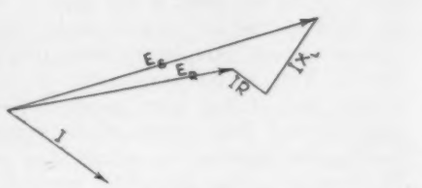
The housing is sheet metal (60-in. wide, 90-in. long, and 120-in. high). The units are in three tiers, mounted on angle iron racks. The weight is 4,250 lb.

The series capacitor is an assembly of capacitance units connected in series with the conductor of a circuit, in contrast to the more commonly used shunt-connected capacitor for power factor correction. A series capacitor carries the full line current at whatever point it is placed in a circuit. A voltage is built up across the unit which, at all times, is proportional to the load current flowing. This voltage is opposite to the voltage drop across an inductance and, therefore, by proper choice of a capacitor, it is possible to neutralize the voltage drop caused by the inductance of a circuit. It is not possible to neutralize the resistance drop in exactly the same manner, but by use of a capacitance in excess of the amount required to neutralize the inductive voltage drop, it is possible to obtain a receiving voltage which is higher than the sending voltage.

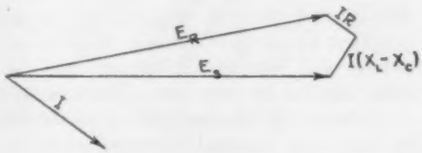
Since the corrective effect is at right angles to the current, the power factor of the load is very important in determining the capacitor size required for a given compensation. Its use can seldom be justified when the power factor exceeds 90 per cent.

Since the voltage change across the capacitor is simultaneous with the changes of current, it will correct the voltage drop caused by starting large motors or other large appliances. Other methods of voltage regulation which depend upon a mechanical operation, such as induction regulators or step voltage regulators, are too slow to compensate for voltage drops caused by instantaneous changes of current. Either an increase in system voltage or a combination of increased conductor size with an induction regulator are the only practical competitors with a series capacitor.

The installation consists of a gang-operated paralleling switch, two gang-operated disconnect and grounding switches mechanically interconnected, and two sets of single-pole disconnect switches for the main (Moffat) supply



VECTOR DIAGRAM WITHOUT CAPACITOR.



VECTOR DIAGRAM WITH CAPACITOR.

Fig. 2—Effect of series capacitor in a transmission circuit. Nomenclatures are as follows:

E_s = *Sending voltage.*
E_r = *Receiving voltage.*
R = *Resistance ohms.*
X_L = *Inductive reactance.*
X_c = *Capacitance.*
I = *Load current.*

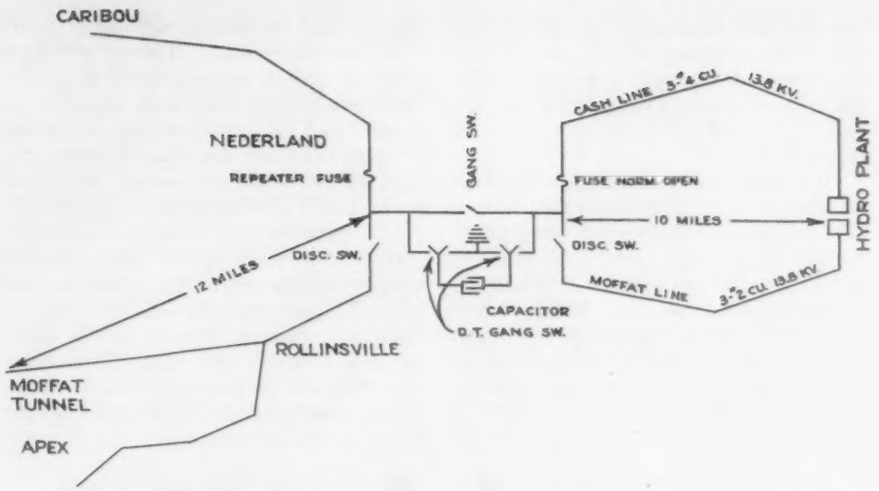
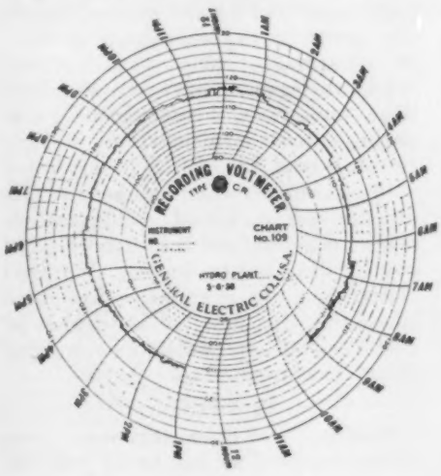
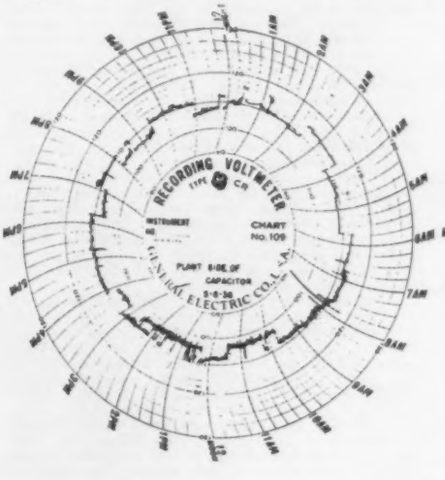


Fig. 3—Connection diagram for the series capacitor

R. M. E. A. Report





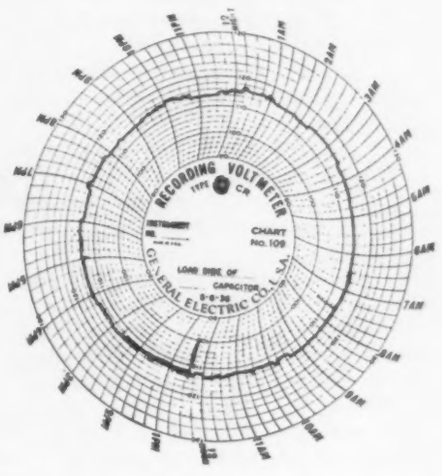


Fig. 4—Voltage charts showing (left) voltage at hydro plant bus, (center) voltage at plant side of the capacitor, and (right) voltage on load side of capacitor

line and the main (Moffat) distribution line. The auxiliary supply line (Cash) is connected through a set of single-shot fuses, while the Nederland-Caribou line is supplied through a set of repeater fuses.

This capacitor unit has now been in satisfactory operation for nearly a year. The voltage charts attached were taken on the 6th of May, 1936, with the 500 hp. fan motor in operation. The load on the line varied from 400 to 1,600 kva., with a power factor from 75 per cent to 80 per cent and a load factor of 65 per cent. The voltage drop from the plant to the capacitor is 8 volts at full load, with an instantaneous fluctuation of 5 to 6 volts on starting or stopping the fan motor. These variations were corrected or compensated by the capacitor, so that a 24-hour variation of 2 volts and the maximum instantaneous voltage variation less than 2 volts (except where the supply voltage fluctuated as indicated on the Hydro Plant chart) can be expected. The charts show more clearly the effect of the plant bus or supply voltage regulation, and also the effect of the capacitor on line surges. Note the voltage around 12:00 midnight and before 8:00 a.m. The series capacitor compensates only for voltage fluctuations caused by current passing through the capacitor.

● ●

Accident Prevention Methods Recommended to R.M.E.A.

By CHARLES F. DWYER
Public Service Co. of Colorado
Denver, Colorado.

R. M. E. A. Report

NATIONALLY, the industrial accident record is one which may cause us to pause and reflect. With industrial recovery there has come a decided increase in both the frequency and severity of industrial accidents. If present trends continue the 1936 industrial accident record will approximate 30,000 deaths and something like 1,000,000 injuries. Should this prediction prove true it will mean that in spite of the efforts which have been made to reduce accidents that we have lost all the ground which has been gained and are back where we were ten years ago.

The utilities are steady and consistent contributors to industrial accidents. An increase in accident frequency in the Rocky Mountain area is indicated. It is too early to completely analyze the causes for this increase in industrial accidents but these contributing causes are quite apparent:

1. Suspension, partially or completely, of accident prevention activity during the depression.
2. Failure on the part of examining physicians to detect subjective disease tendencies.
3. Lowered morale on the part of employees generally.
4. Failure on the part of management to rate accident prevention as a major activity.
5. Inadequate training and supervision of new employees.

These five points are only recorded after careful study and the elimination of all causes except those which were considered the worst. A brief discussion, or explanation, of each of these points may not be out of place.

1. It is generally accepted that if it is desired to develop safety-mindedness in men that ways and means must be found to keep the subject consistently before their minds. Such things as first aid training, the periodic safety meeting, first aid contests, were all helpful along this line but all of these were badly curtailed during recent years. Probably the greatest help towards eliminating accidents from a property is to assemble each group with its foreman in periodic meetings, there the foreman to exercise his teaching function, this to be followed with adequate field supervision to see that teaching and instructions are carried out. This is not a popular duty with foremen, the majority of whom are not selected for their ability to teach. Safety meetings are very liable to swing off into channels which mean but little to the men involved but when limited to shop talk between foremen and men they are a tremendous force in preventing accidents. The foreman is generally the selector of men, is always the trainer and supervisor of men and when his responsibility for accidents to his men is made complete results will begin to show.

2. This cause has been very apparent since the re-employment of men started. Everywhere complaints are heard of the type of men who are available for hire. These men apparently do not measure up to, or compare favorably with, the men who were available in the labor market some years back. Physical examination requirements expected of physicians are proving too superficial. We only expect a physician to detect an eye out, or an arm off, but a blood disease, or a mental quirk, rendering a man undesirable, cannot be detected by present methods. It is apparent that present methods of examining employees are inadequate and until such time as these examinations are made more complete industry will continue to be severely penalized.

3. This topic has been reviewed so often that our discussion may be brief. Mental disturbance, from whatever cause, is probably the greatest single factor in industrial accidents. The experiences of the past few years, with the uncertainty of the future, the slow improvement in wage scales, all tend toward lowered morale, and dispirited men are decidedly accident prone.

4. Management has been inclined to accept accidents as an integral part of industry, an unavoidable cost, instead of recognizing that the accident record of a given company is almost completely in its own hands. Management may have exactly the accident record which it pleases and by the same reckoning a bad accident record is directly chargeable to the management.

5. Whether new employees are selected through a personnel department or more directly by foremen and superintendents, recent accident records indicate that whatever the method the selection of new employees must be given more thought if accidents are to be reduced among this group. The training which a foreman can give to a new man is apparently not proving adequate. Some sections are meeting this situation by assigning to each new man a so-called sponsor during his probational period to quicker teach the novice company rules and methods and to quicker develop safe working habits.

To break this report down into topics which we may discuss briefly indicating the field that is to be covered we may consider accidents to and preventive measures for employees, the public and customers.

Employees

The scope of this Committee is limited insofar as employees are concerned to the assembling and spreading of new ideas that are developed in the industry; the collecting of information on accepted practices throughout the country and handing it on to those to whom it would be helpful in this area. One development which is apparently destined to come into general use in the immediate future is the so-called "hot stick." The hot stick is the answer to the need of the industry to make line repairs without completely interrupting service. This art has made great strides of late and it has been satisfactorily demonstrated that repairs made under this method entailed no greater risk to the employee than do older methods. One warning which is given by all advocates of the hot stick method is that when introduced it be done very slowly and the job selected for initial practice be simple enough so that accident will not result before men become skilled in their use. There is still a question in the minds of observers of this new method whether men engaged in the handling of hot line tools should be limited to this type of work only, or whether a man may be safely trusted to work under hot line tool methods one day and under clearance methods the next. The majority lean towards the hot tool group to do nothing but this line of work.

With the growth of each system and its incidental complications more explicit rules and greater general knowledge are needed of such things as "hold off systems," "cable identification," "temporary grounding," etc. As any of these topics would require an entire paper in itself they will only be suggested here.

First aid knowledge has been gradually spreading among employees actively engaged in the handling of electric lines and equipment. We don't believe that we are going too far in advocating that first aid knowledge be made compulsory among this type of utility employee.

The Public

Perhaps the most important item under this heading has to do with the

relations existing between the service company and the local fire department. The risk to firemen personally and to the public at large from falling lines while fire fighting apparatus is in operation is quite obvious. Educational work tending to prevent accidents may be done by teaching firemen to be as considerate as possible of electric lines and setting up a complete understanding as to who may order electric lines de-energized.

Another point which merits serious consideration is the advisability of continuing to erect or operate electric lines adjacent to high speed highways. The number of lines and poles broken by automobiles leaving the highway is increasing and the advisability of moving lines farther from the highway may well be studied.

The grounding of fences adjacent to, or crossing under, power line should be generally practiced. One difficulty which has been encountered where grounding is practiced is that the grounds are frequently knocked off. The more frequent use of the steel or iron post would be helpful.

There is a growing tendency and advocated quite often in farm magazines to use energized low tension wires as cattle guards. It is needless to say that this method is very effective but it might easily prove too effective not only to cattle, but to human beings. The practice should be discouraged.

The Customer

Frequent accidents occur on customer property where the cause is plainly lack of knowledge of electrical hazards on the part of their employees. The authority of the utility generally does not extend on to the customer property. But it would seem that there is a field for diplomatic approach to this problem wherein the knowledge necessary to install and operate electric equipment might be gradually spread by the utility company to the customer and his employees, thus saving accident to them and a black-eye to the industry.

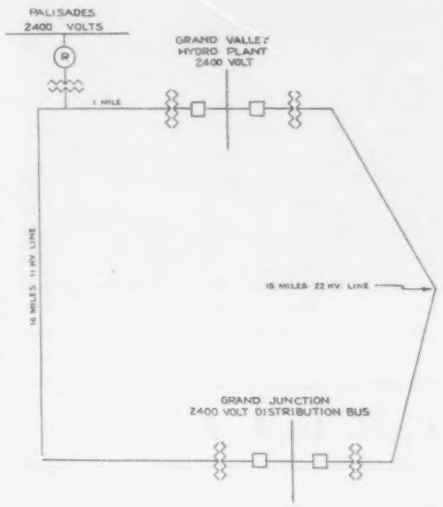
Another point which is much discussed is to what extent the dangers of electricity should be stressed in dealing with a prospective customer. The thought seems to prevail today that the use of electricity in all households is so general that the customer may be warned of the things which he should avoid if he would keep free from injury.

*Accident Prevention Committee.
Fred Reberg, Mountain States Power Co., Casper, Wyo.
Chas. F. Dwyer, Public Service Co., Denver, Colo.
E. M. Conwell, Albuquerque G. and E. Co., Albuquerque, N. M.
E. B. Hornbaker, Southern Colorado Power Co., Pueblo, Colo.
Lee R. Jones, Colorado Central Power Co., Englewood, Colo.

Step Regulator Solves Difficult Regulation Problem

WHEN the Grand Valley Hydro Plant was completed and the Steam Plant at Grand Junction closed down, a serious regulating problem developed at the town of Palisades. (See sketch).

The Grand Valley Hydro Plant bus is regulated for the Grand Junction distribution system. It is compensated for the voltage drop over a 22-kv. line, 15 miles long, in parallel with an 11-kv. line, 17 miles long, and the transformer drop at both ends. Since Palisades is located only one mile from the Hydro Plant, it was exposed to a voltage variation from 108 volts during the off-peak period to 123 volts during the peak load period.



The revenue from Palisades with a population of 1,000 does not justify the high investment required for a set of induction regulators, but since the type of service required is relatively high, two 15-kva., 2,400-volt, branch voltage regulators were installed early in 1936. These regulators are auto transformers with four 2½ per cent taps. A tertiary winding supplies the energy for the control and motor circuits. The following ranges of regulation can be obtained:

Neutral to 10 per cent rise.
2½ per cent lower to 7½ per cent rise
5 per cent lower to 5 per cent rise
7½ per cent lower to 2½ per cent rise
10 per cent lower to neutral.

The regulators are equipped with contact making voltmeter control only. At an additional cost of $100 per regulator, line drop compensators can be added.

The cost of this equipment is approximately one-half that of the lowest-priced, pole-mounted, induction regulator.

The attached charts show that the 24-hour voltage variation was reduced from 15 volts to 3 volts. The abrupt voltage changes between 12:30 p.m. and 3:00 p.m. were due to a 35-hp. coal-cutting machine supplied from the 2,400-volt system. These fluctuations were about the same before the regulators were installed, and are not serious enough to cause complaint. Such rapid voltage changes can be corrected with a series capacitor only.

Voltage charts (left) before regulator installation and (right) after installation

Standards Urged to Prevent Current Diversion

By W. C. QUANDT
Southern Colorado Power Co.
Pueblo, Calif.

THE problem of current diversion, having been given considerable attention by the power companies of the Rocky Mountain section, the metering committee believes that a check of the methods of investigation and disposition of this problem, also the results obtained, would be of interest. Diversion is usually detected by the following methods and importance in the order named:

A. Meter readers.
B. Meter testers.
C. Meter installers.
D. Clues from billing department.
E. Other employees.

Some companies employ special investigators who devote all their time to this work and have proven their worth in the larger organizations. There is considerable variation in the system of compensation. Most companies do not pay a tip for detection, but do pay a bonus to employees who deliver evidence. The highest bonus reported was to inspectors who devote all their time to this work and receive $4.50 for jumpers or closed loops, and $1.80 for lights ahead of the meter.

When a tampered meter has been located the procedure, so far as one major power company is concerned, is as follows:

Meter is removed from service and loop closed, giving temporary service. The customer is then notified to correct the wiring at his expense, and in some cases, the bill is prorated for a period that the records indicate the irregularity existed. If the customer does not comply with this order within 15 days, the service drop is removed. Methods of correction are made at company expense where diversion is suspected but cannot be proven.

In making a tamper-proof installation, all companies report making outdoor installations of the new sequence with the meter ahead of the switch and fuses, using the A, B, C, or S type of installation. Where older types of meters are used for outdoor installations, a cabinet is generally used rather than conversion to the new type. Meters purchased prior to 1914 are not used for outdoor installations. Where type "S" meters are used, it is recommended that meters purchased since 1928 be converted to the socket type.

On one property an accurate check of 62 customers was made and the increase after correction was found to be 83 per cent. The kilowatt hours used by the 62 customers for the month previous to the outdoor installation was 1,281, and 2,342 for the month following the new sequence installation. The 62 customers paid for the outdoor installation.

In Pueblo, 500 outdoor meter installations were made during the first eight months of 1936. One hundred of these installations requiring changes in the wiring were made by the electrical contractor at an average cost of $7.50. The contractor paid fifty cents to the city inspector for inspection, and the power company furnished a meter socket. After the contractor has completed the wiring, it is necessary for the service man to change the location of the service and install the meter.

R. M. E. A. Report

The old service-drop is used and very little material is needed.

Four hundred installations were made by servicemen, where practically all the work was outside the building and no inspection necessary. The average cost of this installation, using steel tube or service drop cable and moving the old service-drop to the new location, is as follows:

Labor	$3.00
Miscellaneous material	2.00
Meter socket	1.50
	$6.50—average cost.

Service drop cable is used where the line would be accessible to the consumer for tapping or connecting a jumper. Approximately one-half of the installations are of this type and the cost, including service drop cable from the pole to the meter through steel tube on the house to the meter socket, is as follows:

Labor	$2.75
Miscellaneous material	5.60
Meter socket	1.50
	$9.85—average cost.

Careful consideration should be given each case in order to decide whether to use service drop cable or the old service as almost 20 per cent of the diversion was at the service. Complete protection is afforded by the drop cable and a new sequence installation. Most properties are using every conceivable type of meter enclosure and protective device for the meter. Such a situation may be costing as much or probably more than a standard program of new installations and replacement which will coordinate with probable future standards and make possible complete interchangeability. The longer the present experimenting continues, the more difficult it will be to secure standardization. The standard type decided upon by a property should include all new meters, and the changing of a certain percentage of the present meters to this standard. If this is not done, additional cost is involved in future handling of connected and disconnected meters.

New meters purchased to replace damaged or obsolete meters should be of the same type, and reduce the number to be changed to the new type. Meters purchased since 1928 can readily be standardized and should furnish any property with enough meters for changing over for a long time. Meters purchased from 1914 to 1928 can be used on old, unprotected installations. Top connected meters purchased prior to 1914 are obsolete and should be gradually discarded as the wiring program proceeds, and old houses are abandoned.

The cost of conversion of a meter to a standard which will conform with those manufactured by the meter companies is approximately $4.00 or $5.00, which includes labor and meter socket or base. Costs of a cabinet with a test block are from $3.00 to $4.00, or about $1.00 less than a standard changeover, which will more than pay for the difference in the cost of future meter changes. We are convinced that the diversion situation is serious. E. E. I. committee reports indicate that probably 18 per cent of the electric consumers are diverting current, and that the average loss of revenue per diversion is $26.00 per year. We recommend that definite policies of detection and prevention be adopted without delay.

*METER COMMITTEE:
Rocky Mountain Electrical Association.
Mr. W. C. Quandt, Southern Colorado Power Co., Pueblo, Chairman.
Mr. E. P. Hodges, Public Service Power Company, Denver, Colorado.
Mr. F. M. Howard, Mountain States Power Company, Casper, Wyomnig.
Mr. E. D. Kipp, Albuquerque Gas & Electric Co., Albuquerque. New Mexico.
Mr. W. J. Dolde, Albuquerque Gas & Electric Co., Albuquerque, New Mexico.
Mr. R. E. Jones, Colorado Central Power Co., Englewood, Colorado.

Significant Trends + + +

[Signposts which point the road to improved business or method, brief, pertinent, useful hints as to HOW someone has blazed a new trail]

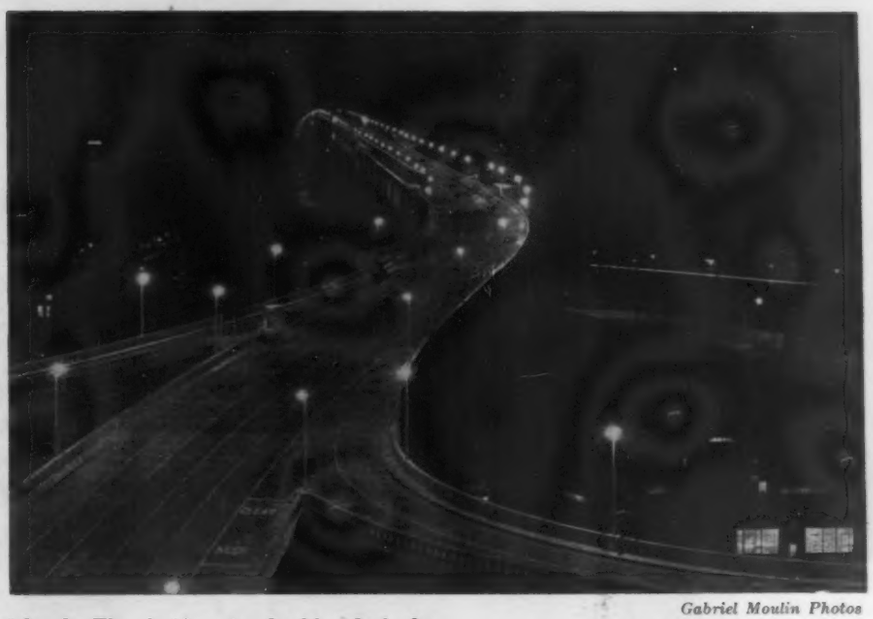
Bay Bridge Lighting

CALIFORNIA'S newest highway link, the San Francisco-Oakland Bay Bridge joining its namesake cities, is the finest example of roadway illumination in the world. High speed travel both day and night was considered essential to handle the heavy traffic without congestion. 922 sodium vapor lighting units and 35 mazda luminares have been installed along the 13.7 miles of roadway to make fast night driving safe.

The bridge proper consists of two tandem suspension spans joining San Francisco and Yerba Buena, the island in the middle of the Bay. A 500-ft., 50-ft. dia., 2 deck tunnel through the island joins the suspension structure with a 1,400-ft. cantilever span and 8 trussed construction spans extending from the approaches on the Oakland shore to the island. The bridge is double decked, the top deck accommodating 6 high-speed automobile traffic lanes and the lower deck, 3 truck and bus lanes and 2 electric interurban tracks. Including the double deck portion and approaches the total length of roadway is 13.7 miles.

Details of the lighting installation for the various portions of the bridge and approaches is described in the captions of the accompanying photographs. An unusually high efficiency has been obtained in the lighting installation, the average lumen per foot being 133.3 which produces an average foot candle intensity at the roadway of .84 foot candles.

Cost of energy including lighting of



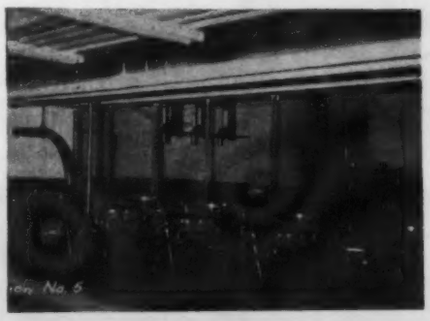
Gabriel Moulin Photos

View of the San Francisco approach showing the "on" and "off" ramps. The Oakland Mole roadway and Toll House structure, 3½ miles away, are clearly visible at the upper right

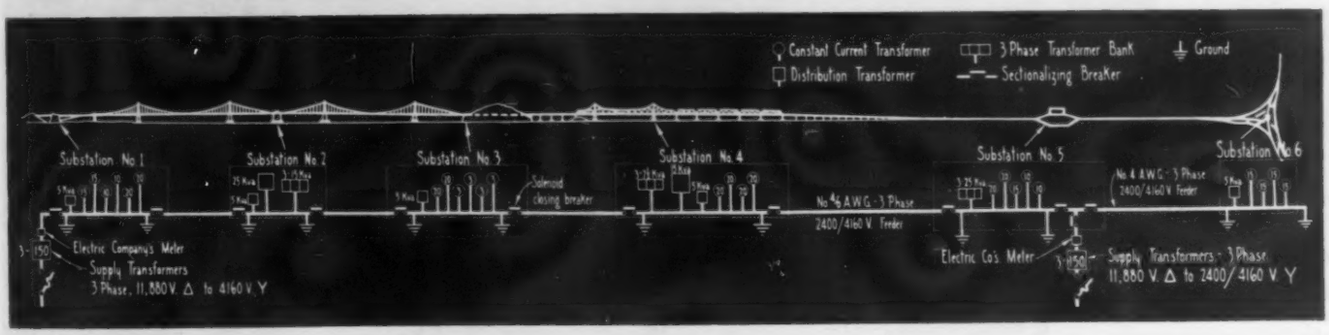
Statistics

Length of bridge and approaches	49,986 ft.
Length of roadways	13.7 mi.
No. of 10,000-lumen sodium vapor luminaires	922
No. of Mazda luminaires	35
Spacing of units (set opposite)	150 ft.
Ave. mounting height	25 ft.
Ave. monthly consumption	98,500 kw.-hrs.
Lumens per foot	133
Ave. Ft.-Candles on roadway	0.84

Interior view of substation No. 5 shows the compact arrangement of mounting the street lighting transformers, disconnecting switches and oil fuses. Note the use of a bus gutter at the base of the installation. Conduits above this raceway are of bronze to eliminate corrosion and minimize the possibility of hysteresis losses



Electrical diagram for bridge lighting and power. Energy is supplied at either end of the bridge and distributed along the structure through a 2,400/4,160 volt, 3 phase main feeder. This feeder is sectionalized at either side of 6 distribution substations located along the structure. Circuit breakers are both electrically and mechanically interlocked to prevent synchronizing power company networks on either side of the bay. These substations control all of the roadway and other lighting


Constant Current Transformer
Distribution Transformer
3 Phase Transformer Bank
Sectionalizing Breaker
Ground
Substation No. 1
Substation No. 2
Substation No. 3
Substation No. 4
Substation No. 5
Substation No. 6
Solenoid closing breaker
No 4/0 A.W.G. - 3 Phase 2400/4160 V. Feeder
No. 4 A.W.G. - 3 Phase 2400/4160 V. Feeder
Electric Company's Meter
Supply Transformers 3 Phase, 11,880 V. Δ to 4160 V. Y
Electric Co's. Meter
Supply Transformers - 3 Phase 11,880 V. Δ to 2400/4160 V. Y

L e f t — Double deck roadway lighting on the suspension spans. On the upper six lane roadway, 10,000 lumen sodium vapor lighting units are spaced 150 ft apart, set opposite, and mounted on octagonal tapered steel standards supporting the units approximately 25 ft. above the roadway level. The lower deck is illuminated by a single row of 10,000 lumen sodium vapor units installed approximately 120 ft. apart and attached to the under side of the girders supporting the upper roadway. (Center) Clear visibility is afforded the night driver on the roadways of the bridge. A comparison of size is afforded by the automobile traveling along the center lane

Gabriel Moulin Photos

Visual acuity which brings out etails as small as bridge rivets undreds of feet away testifies of e highway lighting installation of e lower deck of the structure. he 10,000 lumen sodium vapor nits are supported from the floor eams of the upper roadway

A portion of the Oakland approach to the Bay bridge. At the extreme left may be seen the sodium-vapor lighting units at the western end of the Oakland distribution cloverleaf which provides vertical separation of various approaches to the mole proper and thereby eliminates traffic congestion and danger. Lighting units on this section are mounted on steel standards 24 ft. 6 in. high to the light center.

Looking west toward the truss structure which comprises the eastern half of the bridge. On the truss and cantilever spans lighting units are mounted on steel bracket arms extending over the roadway.

Above — Ten traffic lanes on the Oakland mole are lighted by two rows of double 10,000 lumen sodium-vapor lighting standards. The center six-lane highway is a continuation of the upper deck roadway of the bridge and the two outside two-lane highways are for east- and west-bound truck traffic traveling on the lower deck of the bridge. Left — Looking east from the Yerba Buena Island toward Oakland. The Key System mole shown below the bridge in the upper center will be discontinued next year when high-speed electric interurban trains will run on the tracks provided on the lower deck of the bridge. This time exposure of the roadway testifies to the evenness of the distribution of light on the roadway surface.

Gabriel Moulin Photos

Lighting in the double deck tunnel through Yerba Buena Island is a continuation of the bridge lighting. The sodium-vapor units are suspended from brackets bolted into the tunnel wall.

adjacent streets is estimated to be approximately $22,000 per year. To this figure must be added the maintenance on the lighting unit, the chief item of which is the replacement of sodium vapor lamps every six months, the burning light being 2,000 hrs.

Circuits for all roadway lighting are 6.6 ampere series alternating current with individual series transformers for each lamp. Transformers for the 10,000 lumen sodium vapor units have a 1 to 1 ratio and for the mazda units have a ratio of 6.6/20 amperes. Aviation, navigation and fog signals are served from 120-240 volt, 3-wire circuits. The total connected load on the bridge for lighting and power is approximately 307 kw., the estimated demand 285 kw. and the annual kw. consumption 1,181,932.

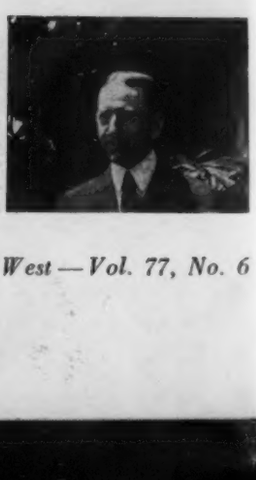
Ted Rosenberg and Frank Gentles, of the Atla Electrical & Mechanical Co. of San Francisco, are shown congratulating each other on the successful completion of the electrical installation contract for the entire structure.

Centralized control for all bridge lighting circuits is provided on this unusual switchboard. Installed in the toll house plaza, this board extends across one wall of the operating room. A plan and elevation of the bridge together with all lighting circuits are engraved on its micarta surface. Indicating lights show the condition of all circuits on the structure. Control by the switches shown is through direct current relays to the various substations located along the structure. H. A. Tilson, electrical engineer for the California Bay Bridge Authority and one of the designers of the electrical installation on the bridge, is shown at the board

Tom Bennett (left), chief estimator for Atla Electric, and Charles F. Lane, superintendent of construction for the Atla Electric Co., in charge of the field electrical installation work on the bridge

Maintenance of the sodium-vapor lighting units is facilitated by this special truck. Paul Doty and Karl Koch, of General Electric's San Francisco office, are shown preparing one of the twin 10,000 sodium-vapor units for operation

Standard sodium-vapor luminaire unit on one of the approaches. Close inspection at the base will show the method of mounting the series transformer in a recess in the concrete foundation. Bridge lighting cable on the approaches is bronze armored with a double jute covering to prevent soil corrosion.



William P. Bear, lighting specialist for the Pacific Gas and Electric Co., contributed his knowledge to success of the power and lighting installation

Vacuum Tubes in Action

III. Rectifier Circuits

By H. C. STANLEY
Asst. Engineer, General Electric Co.
San Francisco, Calif.

THERE are numerous ways of applying vacuum tubes in rectifier circuits. The simplest circuit employs one two-electrode tube as shown in Fig. 1.

A transformer is necessary for two reasons, first, to obtain a low voltage for heating the filament (usually about 6 volts) and, second, as a means of supplying a value of a.c. voltage that will give the required value of d.c. voltage. The transformer is usually provided with taps so that the d.c. voltage can be adjusted over any desired range. It is apparent that current can flow through the tube only when transformer terminal A is positive, and that when B is positive no current can flow. Consequently, the transformer can pass current in one direction only, and we have a half-wave rectifier. The d.c. current is pulsating, but always flows in the same direction.

It should be noted that currents in vacuum tubes always flow from the anode to the cathode, although the flow of electrons is always from the cathode to the anode. The current actually flows in the same direction as the electrons, as electric currents are carried by electrons. However, the scientists who established the definition of electric polarity did not have the present day knowledge of the habits of electrons.

Fig. 2 shows a method of obtaining full wave rectification by the use of two two-electrode tubes. This scheme allows the tube on the left hand to carry current when A is positive and the tube on the right hand to carry current when B is positive so that current can flow in the d.c. load over both halves of the a.c. wave. The current returns to the transformer by way of a mid tap in the secondary winding. The same result can be obtained by the use of one tube having one cathode and two anodes connected as shown in Fig. 3.

The rectified currents as obtained by any of the methods described, pulsate to a certain extent but these pulsations can be smoothed out to any desired degree by the use of filters composed of capacitors and reactors in the d.c. circuit, such as shown in Fig. 4. Any change in the current passing through the reactor causes a change in flux in the reactor core, which change tends to hold the current constant. The capacitors absorb current when the voltage is high and serve to maintain voltage when it tends to droop.

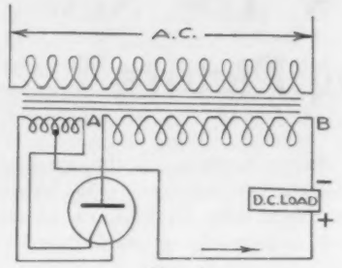


Fig. 1

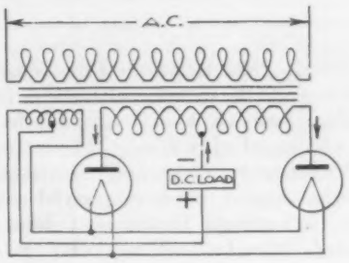


Fig. 2

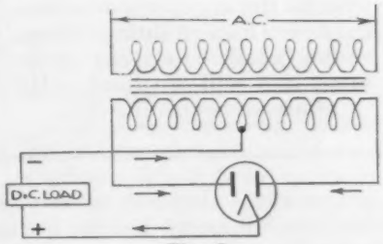


Fig. 3

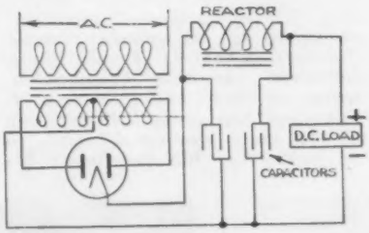


Fig. 4

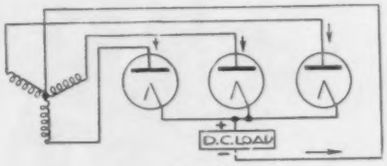


Fig. 5

Three-phase circuits are usually used when large d.c. loads are involved.

The secondary windings can be connected for two, three, six or twelve phase. A three-phase circuit is shown in Fig. 5. In this case three individual tubes are used. The cathodes are all connected together and can be heated from the same filament transformer.

The connections are similar for six phase and twelve phase, except the number of transformer secondary windings and tubes are increased in proportion.

In Fig. 1 there is one pulsation of current in the d.c. load per a.c. cycle, in Figs. 2 and 3 there are two pulsations. in Fig. 5 there are three pulsations, and six and twelve pulsations per cycle in six-phase and twelve-phase circuits respectively. These pulsations overlap in the polyphase circuits and produce a smoother output.

In the familiar mercury arc rectifiers such as used in moving picture and storage battery work, two-anode mercury pool tubes are used. An auxiliary anode, called the starting anode, is needed for starting the current. This starting anode is located near the cathode pool, so that when the tube is tilted a bridge of mercury connects across, permitting a current to flow from a low voltage source. When the tube is returned to its normal position this bridge of mercury is broken, thus causing an arc, the heat of which liberates a quantity of electrons. The positive potential of the main anodes attracts these liberated electrons, resulting in ionization of the mercury vapor and the tube goes into service.

Mercury arc rectifier tubes are also used for supplying direct current for series street-lighting circuits. Due to the higher voltage of these circuits the tubes are immersed in tanks of oil. These equipments also have automatic shaking devices for the purpose of reestablishing the arc in case of circuit interruption.

The large iron tank rectifiers for furnishing railway load have a mercury pool for the cathode and operate on exactly the same principle as the glass tubes. All the anodes, 3, 6 or 12 are located in the top of a single tank and the firing progresses from one anode to the next, each anode taking its turn. In modern rectifiers each anode is located in a separate chamber, and grids are mounted in the mouths of these chambers so that the electron stream must pass through these grids in order to reach the anodes. The passage of electrons can thus be controlled by application of voltage to the grids. The grid voltage can be controlled by a voltage regulator resulting in automatic voltage regulation of the d.c. output.

With the Trade Associations + + +

An Exchange of Plans and Ideas for Assisting the Industry in All Branches to Solve Some of Its Problems of Trade Relations and Business Ethics

Contractors View The New Merchandising Picture

CONSIDERABLE change has taken place in the electrical appliance industry in Vancouver during the past few years. In pre-depression years, Vancouver had considerably more than its quota of small dealers handling appliances. A large number of these were also firms who were actively engaged in residential wiring and smaller industrial contracting business. With the passing of the years, however, this situation has entirely changed, and now there are comparatively few contractors in Vancouver who are also engaged in the merchandising of appliances.

The classified section of the Vancouver telephone directory only lists six firms under the electric appliance heading, while there is also a full column listed under electrical contractors and it is a recognized fact that a great many of the contractors are not included in this list. The list of firms under the electrical repairing and electrical service classifications of the directory are also many times larger than the list of appliance dealers.

This whole situation was under discussion at a recent meeting of the Vancouver Electrical Assn. when the suggestion was made that an electrical merchandising section of the association should be established. The proposal was advanced by R. Wallace, chairman of the merchandising committee of the association, and after discussion was left over for consideration at a further meeting. Mr. Wallace suggested that a number of the electrical merchandise dealers of Vancouver should be solicited to join the association. Arising out of this discussion the question was asked what had become of the dealer-contractor in Vancouver.

While this happened in Vancouver, B. C., the situation is the same in practically all localities of the West. That the Vancouver electrical contractors faced their problem with realism instead of heat, and concluded to take advantage of the situation as it exists, cooperating with the merchants and central station who do the appliance business rather than fighting them, shows good business judgment and will undoubtedly show better profits also.

The feeling of the members was that merchandising today has become such a complicated situation that it is no longer possible for the electrical man to handle the merchandising of appliances as a successful sideline. Instalment buying of appliances is now practically universal and in addition it was claimed dealers have to contend with the problem of wholesalers selling direct to consumers. In view of this situation, the majority of the contractors have come to the conclusion that it is much more satisfactory to work with the central station in the merchandising of appliances, or to co-operate with some other retail organization which is specializing in the retailing of appliances.

Contractors when they find a customer in the majority of cases turn in the name to the central station. Under an agreement with the association, the B. C. Electric Railway Co. endeavors to complete the sale and if successful a commission is paid to the contractor.

A number of contractors also have on display in their showrooms a range, a water heater, and possibly one or two other appliances which are placed in the showrooms on consignment by the central station. These are used practically solely for display purposes with a view to selling appliances which are financed through the B. C. Electric Rail-

Candid camera shots at the recent Southwestern Section, inspectors convention at Fresno. Left to right: George Kimball, Industrial Accident Commission, explaining the safety net used on Golden Gate bridge; A. V. Youens, Palo Alto, chairman of the newly formed Northern Chapter; Frank Short, Industrial Accident Commission, telling of electrical fatalities; E. J. Crawford, San Joaquin Power, one of the hosts inviting delegates to an engineers club luncheon; beside him, seated, Ralph Wiley, I.A.E.I. president, San Francisco; I.A.E.I. Secretary Vic Tousley, and Tom Coyle, president of the Southwestern Section; G. E. Price, Orange county electrical inspector, and fog corrosion observer

way Co., and a commission on the sale is paid to the contractor.

Music dealers have also considerably changed the picture in Vancouver insofar as appliance merchandising is concerned. At the present time some of the largest electrical merchandising displays in the city are being handled by firms which were formerly engaged exclusively in the sale of pianos, sheet music, and musical instruments. With the addition of radio, these firms gradually branched out into the electrical appliance field and some of them have now gone so far as even to become interested in the fixture trade.

Hardware dealers have also made considerable inroads into the business. In the downtown area in Vancouver, hardware dealers have not devoted very much attention to electrical appliances, but these are being featured to a considerable degree in the suburban stores. One large wholesale hardware firm has, however, opened a large retail store in the downtown area and is operating a large electrical department in connection with this establishment.

In view of the whole situation as it now exists, the general concensus of opinion amongst contractors, many of whom formerly also operated their own retail stores, is that the day of the contractor-dealer is gone. They claim that today it is necessary to sell a very large volume of appliances in order to cover the overhead involved in such sales. In support of this argument they maintain that the average contractor is not conversant in the handling of paper and as a result loses considerable time in these transactions or else has to employ someone to handle the financial details of the installment business. In preference to this it is claimed it is very much more profitable to operate on a smaller percentage basis and collect a commission from the central station or some other organization with which the retailer has placed the prospective buyer in touch.

A number of the contractors also state that some of their most harmonious relations and some of their best business have been directed to them through the music houses which are now engaged in the merchandising of appliances.

There is another angle to the situation also. It is contended that formerly when a contractor sold appliances to a customer and then went up to arrange regarding the necessary installation, particularly in the case of electric ranges, the customer felt that he was being robbed when he was told that an additional expenditure had to be made in wiring for the range. In the case of a customer buying the range from a firm which is engaged exclusively in the appliance merchandising business and having to contact an entirely new firm to handle the installation work, this problem is eliminated, and it is indeed rare when a charge for installation work done in this way is disputed by a customer.

Taken as a whole, the contractor dealers in Vancouver are very much more satisfied with the new situation than that which formerly existed when they also were engaged in the merchandsiing of appliances through their own stores.

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Contractors Convention to Hear New Executive

SO complete a coverage of the national convention at Atlantic City of the National Electrical Contractors Assn. has been reported both in the *"Qualified Electrical Contractor,"* issued by the N.E.C.A., and in *Electrical Contracting* magazine for November that space will not be devoted to it here. However, that convention and its deliberations will be the subject of considerable discussion at the convention of the Northern California Chapter, N.E.C.A., held in Sacramento, Dec. 5. A. L. Stone, newly appointed executive committee member for the ninth district, plans to attend and give a word picture of the association's national program and of the new basis of dues proposed by the executive committee for financing the association.

Other features planned on the program are a business analysis talk by Frank Boyd, Pacific Electric Motor Co., Oakland. His talk at the Fresno meeting will be remembered by all who attended. It was in such demand that copies were made and sent to all members after the Fresno meeting.

Another feature will be a report from Roy N. Butcher, San Jose electrical contractor and chairman of the State of California Contractors License Board, who will tell how the operation of this act is effecting improvements in bidding practices, collection of accounts for subcontractors, and in general policing the contracting business and thus raising its level throughout California. He will also point out how further improvements in the legislation can be made with the assistance of the building industry.

H. H. Courtright, of Fresno, will tell how the coordination plan for cooperation between the various branches of the industry under contractor guidance as advocated by President Earl N. Peak is operating in the Central Valley region. A. L. Stone will likewise describe the Southern California coordination activity and how it operates.

Charles A. Langlais, president of the Northern Chapter, has issued an invitation to all contractors in the region, whether members of the association or not, because of the importance of the subjects to be discussed and the place which contractors can make for themselves in future electrical development of the region.

Straight from the Shoulder of I.A.E.I. President Wiley

at recent Inspector Conventions

Attitude—

The attitude of the public toward any inspection bureau, whether it is held in high regard or looked upon with misgivings, is definitely determined by the manner in which the bureau functions. It is my opinion that the inspection bureau that enjoys a good reputation is one in which the head of the department and the inspection force carry on inspection work from a broad and common sense standpoint rather than from a narrow and arbitrary one.

Adequacy—

I think the question of adequacy in electrical wiring one of the most important subjects we have to deal with. A sufficient amount of copper, and number of outlets in both residential and commercial installations will not only help increase the sale of appliances with the resultant upbuilding of load for the utilities, but what is more important, from the inspectors standpoint, it will minimize the amount of substandard extensions made by the handyman, which as you well know, is a large contributing factor in causing fatalities and loss of property by fire.

Engineers—

Regarding engineered installations: I am afraid some electrical engineers seem to be under the impression that they must skimp the job and ask for unreasonably low diversities to justify their fee. As a matter of fact, in many cases when it is desired to add small additional loads to such installations, it requires an unnecessarily large expenditure of money to take care of the additional increase in load, which would have been unnecessary if the original installation had not been trimmed to the limit.

EDITORIAL + + +

Vox Populi

THREE interpretations can be placed upon the popular verdict handed down in the presidential election by the highly emotional court of public opinion. Significance of this verdict to the electrical industry depends upon the viewpoint of the interpreter—whether he bases his translation upon a political, public relations or economic inference. In no case can the election be interpreted as a signal for hasty or ill-conceived action. It does not signify the doom of the private power companies, but it does indicate the need for a change in mental attitude.

Politically one might judge that the utility business has "been moved off the innermost circle of the target." New Deal landslides in Oregon and Washington paradoxically were accompanied by overwhelming defeats for two public ownership measures. Does not the popular verdict indicate that a cooperative solution to some of the present conflicts between the industry and the Administration would meet with approval? Without being conciliatory, would it not be possible for the industry to work out a program which would restrict the field of governmental operation and which would preserve those of the private industry? Obviously the industry can and will fight for its legal and constitutional rights in the courts, but such action should bear no taint of baiting the Administration. The time for antagonism and bitterness between business and the Administration has passed.

Viewed in the light of public relations, the election indicated a tremendous amount of hostility toward Big Business in general. It bore out the statement made just a few weeks previously by Edward L. Bernays, who said "Private business, in the old sense, does not exist in America any longer. Business exists to function for the public. The public realizes this and judges businesses and their products by that criterion. . . ." That this popular hostility may exist in the face of the rendering of a service of the highest order is a fact which the utilities well know. Does not the answer lie in a degree of business statesmanship which will engender public goodwill and public friendship commensurate with the service provided? Our industry and its good works seem lacking in public appreciation. A straightforward story concerning its social utility should get a respectful and sympathetic public hearing. The chain store tax fight in California clearly demonstrated that popular antagonism can be overcome when the public understands that business is the servant and not the master.

From the standpoint of economics the electrical industry has a key role in the overall recovery of business and its future prosperity here in America. Unquestionably the Administration is aware of the economic importance of a prosperous electrical industry for electric power is a basic factor in American progress. Not only is the industry on solid profit-making ground today, but its future was never brighter. Appliance sales are at record peaks. New industrial load is taxing the facilities of both manufacturers and utilities. Kilowatt-hour output is the largest in history. Expenditures of a billion dollars a year to provide the capacity and the facilities to serve these new loads are not inconceivable. These unprecedented demands are providing the leeway for lower and lower rates, which in turn encourage greater usage. Verily here is a picture of opportunity.

Where can there be any cause for alarm over the outcome of the election? In the final analysis the business of providing adequate, reliable and reasonably priced electrical service to the public should be independent of elections and political developments. The electrical industry has a major job of selling more service to more people. Neither past nor future elections should swerve it from that primary purpose.

That Debate

HIGH class talent, at least, crossed verbal swords in the national radio debate on public versus private ownership of electrical utilities sponsored by the National Committee on Debate Material, November 20. On the affirmative were no less than the Socialist presidential candidate, Norman Thomas, and his equally vocally adroit associate Harry W. Laidler, secretary of the League for Industrial Democracy. On the negative were Dr. Gustavus Dyer, of Vanderbilt University, and our own westerner, William Mullendore, executive vice-president of Southern California Edison Co. Ltd.

Those who with misgivings may have wondered by what political puppet strings the selection of the subject was made for this year's debating teams may take heart. If the subject is always as well aired as it was on this occasion, certainly the argument and

persuasion shall not be on one side only as it has been in the press and from the political rostrum these last few years.

Space forbids a complete review of argument on either side. Aside from the familiar contentions on both sides, certain definite challenges stand forth.

Against private ownership and management, although the utopian sales talk of benefits to be derived from an angelically perfect social system have the greatest sucker appeal, the one vulnerable point in the industry's armour seems to be that of capitalization of its debt obligations. The point that the ratio of indebtedness to assets in private companies is 80 per cent as against 12 in publicly owned systems, is a serious challenge. Yet the private initiative which gave birth to the industry and has developed it to its present high status has already been turned toward such a simplification and consolidation of investment.

On the other side, despite appealing theories, ugly actuality as to the government's record in the operation of such public affairs as the postoffice, resettlement, railroads, shipping, and even strictly governmental functions will be hard to live down. When both the southern voiced Dr. Dyer and our own forceful William Mullendore reminded radio listeners of the inefficient and expensive record of such operation, they drew public ownership blood. If regulation, which is a government function, has failed, as the affirmative contended, then why give government a still bigger and more important job of operating and thereby liquidate all regulation?

Healthy and more truly democratic, then, was this debate. Made the prime topic of contention by the administration, with the industry on trial without admitting testimony for the defendant, it is a good sign that the evidence on behalf of private ownership is to be admitted to the court of public opinion at last. In this as in the end it must let the facts, not mere opinions, decide.

In the Spirit of Christmas

LIGHT has assumed a feature role in the festive spirit of Christmas. Illuminated outdoor Christmas trees, decorated buildings and lighting displays in the business sections of many communities have become an integral part of the celebration of Christmas. In this connection the policy of the Utah Power & Light Company is both laudable and worthy of emulation. This progressive utility offers electric service free of charge for the decorative lighting of streets in the business districts of the communities it serves. It also provides the services of its illuminating engineers to help work out the details of these lighting displays. This is a real public service which should win friendship and goodwill.

Sales from Samples

FOR THE salesman who is not afraid of his product, selling out of the sample case is the easiest way to convince the customer of the merits of his proposition. With the completion of the 13 miles of modern highway lighting represented by the 922 sodium vapor lighting units installed on the San Francisco-Oakland Bay Bridge, the traveling public has been given a generous sample of the electrical industry's safety insurance against highway hazards. Being the latest the Bay Bridge lighting installation is by far the finest of its kind in the world. It provides the night automobilist with clear vision for an incredible distance beyond the range of the most powerful headlamp. Even under the most adverse weather conditions (fog to those outside of California) the properties of the economical sodium vapor light permit clarity of vision which make high speed travel possible.

Lighting experts, highway patrolmen and insurance statisticians agree that it is too little vision and not too much speed that is responsible for the appalling toll exacted by dusk-to-dawn accidents. In its modern highway lighting technique, the electrical industry has provided a practical solution for the problem but it remains for public opinion to see to it that the solution is applied to the heavy traffic, inter-city boulevards. Aroused public opinion can demand and obtain adequate lighting for safety on main automobile routes. Allowing the traveling public to actually experience the security obtained by providing effortless vision for night driving is a positive and certain way of arousing the demand for a wider application of highway illumination. Growth of this demand will be stimulated by more and longer sample installations.

General adoption of highway lighting is urgently needed to stem the increasing wastage of lives and resources by avoidable accidents. It is another opportunity for the industry to extend its field to public service and, by creative selling, build more jobs and more business for itself and associated industries.

At this time the huge expenditures required for lighting long stretches of main highways are almost prohibitive. Conversely, sample installations for short, hazardous stretches of road can be economically justified by the lowered accident rate or the increased road capacity possible with adequate vision. It behooves the industry to direct its sales efforts toward the practical proposition—that of obtaining enough sample installations to arouse public opinion to the point of demanding more highway lighting and authorizing the money to pay for the service. Under such a program will come a day, not many years hence, when night driving will be safe on highways flooded with light.

News of Note + + +

California Commission Values Fresno System

"It is a bargain," was the comment of Mayor Z. S. Leymel of Fresno last month when the California State Railroad Commission placed a valuation of $2,890,000 on the Fresno distribution system of the San Joaquin Light & Power Corp.

Of the total, $2,290,000 was declared to be just compensation for properties and rights, and $600,000 for severance damages. Four commissioners signed the opinion. The fifth, William J. Carr dissented on grounds the award should not have exceeded $2,450,000. The company claimed itself entitled to $4,664,000.

The order was to become effective twenty days after Nov 9, the day the decision was rendered. President A. Emory Wishon said the company would make no statement concerning the valuation until the order had been given careful study.

Should the company fail to appeal to either the Federal courts or California Supreme Court before the twenty-day limit, the order becomes final. Fresno, then, must within 60 days initiate proceedings for holding a bond election.

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R. E. Fisher Wins McGraw Medal For Cooperation

Presentation of the James H. McGraw Medal for Cooperation for the year 1936 will be made to R. E. Fisher, vice-president in charge of public relations and sales, Pacific Gas and Electric Co., at an all-industry dinner to be held at the Fairmont Hotel, San Francisco, December 11. Mr. Fisher becomes the twelfth industry leader to win this outstanding award set up in 1925 by Mr. McGraw. He is the third electrical man in the Far West to be so recognized, previous awards having been made to H. H. Courtright in 1928 and to Gaylord B. Buck in 1934.

A former chairman of the Pacific Coast Electrical Bureau and a member of the directorate of that organization and its predecessors almost since its inception, Mr. Fisher has had always an active hand in the promotion of industry cooperation in northern and central California. The basis for the award will be announced in the citation which will be read by R. A. Balzari, president of the McGraw-Hill Co. of California, who will make the presentation as official representative of the committee of judges. W. C. Mullendore, executive

R. E. FISHER

vice-president of the Southern California Edison Co., will be the featured speaker at the industry dinner meeting and A. Emory Wishon, president of the San Joaquin Light & Power Corp., will be toastmaster.

PCEA Operating Economics Prize Paper Contest

Members of the Pacific Coast Electrical Association are urged to compete in the prize paper contest of the Operating Economics Section, entries for which will be received if postmarked not later than April 1, 1937. Entries are limited to 5,000 words.

Subject No. 1—Cable vs. Rigid Conduit for Electrical Service

This paper should discuss the advantages of one type of material over the other, outlining the conditions under which cable may be used, or, if the author is an advocate of rigid conduit, setting forth the case for its use and the exclusion of cable. There are various problems contingent upon a proposed change from rigid conduit to cable, and these should be fully covered.

Subject No. 2—Modern Methods of Maintenance on Governors of Hydro-Electric Units

The subject of hydro electric governors and their maintenance has never been adequately discussed. The papers submitted should deal with all phases of operation and maintenance, bringing out the advantages and economies of methods which have been pursued with a view to disseminating such information among operators in general.

Subject No. 3—Diversity Factor Power Factor and Demand in Domestic Areas

The three factors covered by this subject are related and have a bearing upon each other. They influence or determine the capital investment required for distribution systems. Various appliances used in domestic areas have different influences on the three factors. Many of them are equipped with induction motors and therefore adversely affect power factor. The subject does not limit itself to household appliances, but rather is concerned with whole domestic areas including such services as isolated gasoline stations or neighborhood stores. The changes in the load characteristics of the so-called domestic areas must be recognized and action must be taken to meet the new requirements. Papers submitted on this subject therefore should be quite comprehensive and at the same time should be specific.

Prizes will consist of certificates awarded to the three best papers on each of the above subjects, the prizes to be presented at the general convention to be held by PCEA in May 1937. Send your entry to the Pacific Coast Electrical Association, 601 West Fifth St., Los Angeles, Calif.

Tulare System Not for Sale

Announcement that the Southern California Edison Co. would not sell its Tulare distribution system was made last month by W. C. Mullendore, vice president. He said that the company was, in effect, a cooperative community institution owned by the public, and that sale to the city would not be in the best interest of patrons.

His announcement followed action by the Tulare city council toward acquisition of a municipal system financed by revenue bonds. The council's action in turn followed refusal of Tulare citizens to authorize a proposed $229,000 bond issue for purchase of Edison properties.

●

Montana Power Asks Permission to Refinance

Scheduled to be issued Dec. 1, by the Montana Power Co., were $48,000,000 first and refunding mortgage bonds and $10,589,500 debentures.

In addition to refunding, the financing involves $6,300,000 of new money for construction projects. Chief among these is the Flathead hydroelectric project, started in 1930 and later dropped, which is scheduled to add 56,000 kw. to plant capacity and to cost more than $4,000,000.

The proposed debentures, due in 30 years, were for acquisition of Montana Power Gas Co. assets. Included in the redemption were to be $1,452,125 notes of the American Power & Light Co. of the Electric Bond & Share group, which controls Montana Power.

●

Increased Sales Reported by P. G. & E.

Reporting its preliminary consolidated income for the 12 months ending Sept. 30, Pacific Gas & Electric Co. showed earnings of $2.51 per share of common stock as compared with $1.83 a year ago.

President James B. Black pointed out that, despite reduced rates, both industrial and agricultural demands have shown strong increases. Electric sales increased 12.42 per cent over the comparative period a year ago. Increase in electric revenues was 5.53 per cent. Larger volume of retail trade and better prices for many farm products were cited among factors contributing to the showing.

Gross revenue was $95,292,082, against $90,540,308. Operating costs were $53,466,437, an increase of $1,962,826.

Northwest Defeats Most Public Power Measures

Measures seeking to place the State, or smaller units of government into the power business fared badly in Oregon elections. The Grange Power Bill, proposing public rights to acquire or construct power plants and transmission lines and to issue bonds failed by nearly two to one. The vote was 207,355 against, 111,698 for. In 1934 a similar bill failed by a much narrower margin. Although 45,000 more votes cast this year than in 1934, the proposal found favor with 13,000 fewer voters.

A companion measure proposing a constitutional amendment appointing the State Board of Control as a temporary commission until the regular commission under the Grange Bill could be elected, failed by an even larger majority.

Proposals to form "People's Utility Districts", in Marion and in Lynn Counties. failed by about 1.7 to 1. These were the only two such districts to be voted on at this election, the third, covering parts of seven counties, having failed to get on the ballot by petition.

In Washington, a bill authorizing the State to construct transmission lines was defeated.

Utility districts were proposed in 22 Washington counties. Thirteen carried and nine failed. Those which carried were: Pacific, Lewis, Wahkiakum, and Cowlitz in the southwestern part of the State; Whatcom, Skagit, Snohomish, Okanogan, Chelan and Kittitas in the central area; and Lincoln, Stevens and Pend Oreille in the Northeast. Those defeated were: Clallam, Grays Harbor, Thurston, Clark and Skamania in the West; Douglas and Yakima in the central area, and Walla Walla and Columbia in the Southeast.

•

Utility District Plan Squelched in Kings County

By a vote of 1,910 to 605, citizens of the north Kings County area last month defeated a proposal for annexation of the territory by the Central San Joaquin Municipal Utility District. This was the second annexation election called by the directors of the district since its organization in April, 1935. The first, in western Fresno County, was defeated by two to one.

Campaigning for the annexation was the California Public Ownership League of Sacramento. Opposing it was a group headed by the Kings County Landowners and Taxpayers Assn., made up of prominent farmers and taxpayers of the county. Opposition was based largely upon the unlimited taxing powers of the board.

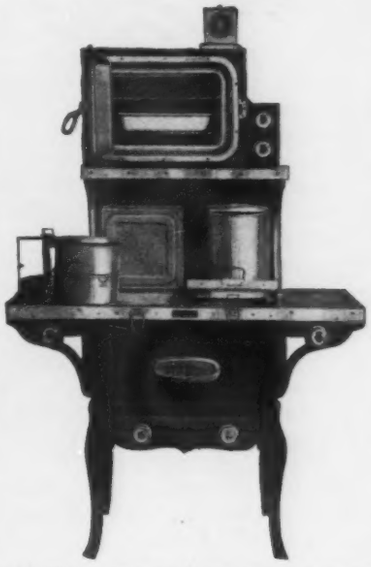
The Standard News

December 1936 — Electrical Edition

Published by THE STANDARD ELECTRIC STOVE CO., Toledo, Ohio

Calling All Dealers

Calling all dealers, especially dealers who have been in business for quite a while. The picture herewith is of a Standard type which was made by us between 1910



and 1914. We need one for our permanent display. Look around and see if you can find one. If so, report it to us, giving full description and serial number, name of user and date put into service. For the oldest one reported, we will exchange it for a new Standard Model No. 1445TA4 with clock and range light. This old range, known as our No. 285, was complete with clock, range light and appliance receptacle, and we feel sure that the user will want to continue to have these advantages which she has been enjoying for over twenty years.

Get your entry in as soon as possible.

Our Twenty-Seventh Catalog

In announcing catalog No.37, which will be ready about December 20th, we are announcing our 27th catalog. In looking back over the numerous catalogs which we have issued we are able to observe the evolutionary process of the development of the electric range from the first days of electric cookery. This catalog should be in your files. Ask for a copy.

Development of electric cookery has progressed from the first types, which were built with one great idea in mind, to produce an electric range that would compete in operating cost with other fuels. Ovens were smaller because of lower wattages. Cookers were in-built in Standards, accounting to a great extent for the popularity of Standards of the earlier days. Connected load was rarely over 6000 watts total, because most distribution systems of those days were not built for heavy loads. Designs were in many cases radically different from existing ranges, because efficiency was the sole object.

Now, electric ranges are built comparable in speed and beauty with all other types of ranges, but still have the added advantage of cleanliness, beauty, safety, economy of operation, time saving and many other distinct advantages.

Standard is ready to serve you with every size and type of electrical cooking device for every purpose, from the smallest bungalow to the largest hotel. And Standards will give your customer long and trouble-free service. Standard also makes a complete line of electric water heaters, from 6 gallons size to 120 gallons, all automatic.

Feel free to call upon us for further information. CHARLES A. PIERSON.

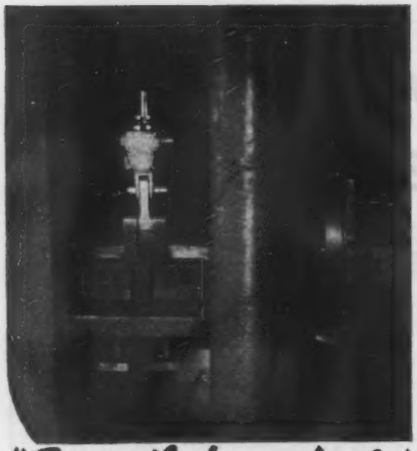
A New Low Priced Range For Heavy Duty

For the wayside stand, Dine-and-Dance spot, for small tea rooms, and cafes. Since repeal, most states require food to be served where liquor is served. Here is a great market for you. A cook stove with relatively low connected load, with great cooking capacity and at a price that will surprise you and your prospective customer. Heavier in duty than the domestic type, it will stand the gaff of hard usage, but still lower in price than a domestic range. Large automatic oven, choice of cooking top plate equipment. Write for further details.

For dependable electric ranges, either write your nearest Standard Distributor or direct to the main office at Toledo. The address is

THE STANDARD ELECTRIC STOVE COMPANY

Toledo, Ohio, U. S. A. Dept. C



"I can't break it!"

That was the answer this advertising writer obtained when he requested an engineer to break a BTC drop forged cap for a speed photograph.

"You see", the engineer continued, "Forgings are elastic. We may be able to get one to tear out at around 30,000 pounds. If you want higher strength we can heat treat it. But we can't actually break one. Millions of fibres make up the internal structure of a forging. These fibres, formed and compacted by the hammering process provide strength and toughness that resist vibratory strain and absorb impact shock. I can stretch one enough to make it let go, but I can't break one."

THE BREWER-TITCHENER CORPORATION
Cortland, New York

Through Your Insulator Manufacturer Only

FOR RELIABILITY, INSIST ON A FORGING

Bay Bridge Transit Plans Are Announced

With the announcement that rapid transit rail facilities across the San Francisco-Oakland Bay Bridge will be ready in January 1938, details of this $16,000,000 rail electrification project have been announced by Glenn B. Woodruff, engineer of design of the California Toll Bridge Authority. The rail electrification including the distribution system will be owned by the Toll Bridge Authority and used jointly by the Southern Pacific Co. and the Key System. This will involve dual voltage consisting of a 1,350-volt overhead system for Southern Pacific and a 625-volt third rail for the Key lines.

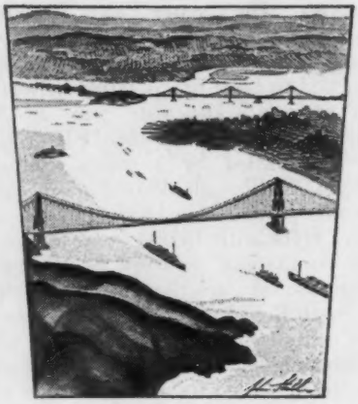
Plans call for three substations located on Rincon Hill, Yerba Buena Island and the Key System Mole. These are to be constructed by the Pacific Gas and Electric Co. with the Bridge Railway lines terminating at the low voltage bus. Conversion to 1,350 volts will be made at the two end substations only, the Island substation furnishing 625 volts only. The planned installations are as follows. Rincon Hill two 2,000-kw., 625-volt rectifiers and two 3.000-kw., 1,350-volt rectifiers; Yerba Buena Island two 2,000-kw., 625-volt rectifiers; Key System Mole two 2,000-kw., 625-volt rectifiers, two 3,000-kw., 1.350-volt rectifiers and one 1,500-kw., 625-volt motor generator set; or a total capacity of 25,500 kw.

Main line overhead system will be made up of an "M" single messenger catenary consisting of one main messenger of 500,000 cm. hard drawn copper, one intermediate messenger of 4/0 hard drawn copper and two contact wires of 4/0, 80 per cent conductivity bronze or a conductivity equivalent to 1,000,000 cm. The system is sectionalized at approximately half mile intervals. The third rail is to be 150 lb. high-conductivity steel with a copper equivalent of 2,530,000 cm. with sectionalizing the same as for the catenary.

Proposed operation of the trains on a 75 second headway is without precedent and involves use of the latest development in the art of railway signaling. Cab signals and automatic train control will be employed. The system provides for four speeds of 35, 25, 17 and 8 miles per hour. For safety the reduction in speed must occur at such a distance as will permit stopping the train by service braking. However, in case the motorman does not promptly respond to his signal, an automatic emergency brake application is made. Again, if the motorman exceeds the safe speed limit, a warning whistle sounds in the cab.

Signals are transmitted by coded track circuits.

For
WESTERN ENTERPRISE



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***YOU CAN MAKE QUICK PROFITS WITH FAST Selling* CLIFTON**

FRICTION TAPE
FRICTION CLOTH
AND SPLICING
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Represented by

GEO. E. HONN CO.
420 MARKET ST., SAN FRANCISCO

ASSOCIATED SALES ENGINEERS
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ALBERT S. KNIGHT CO.
3006 WESTERN AVE., SEATTLE

COMPLETE STOCKS CARRIED AT ALL 3 PACIFIC COAST POINTS

CLIFTON MFG. CO.
65 BROOKSIDE AVE., BOSTON, MASS.

Bids on Ruby Dam To Be Called Soon

Preliminary to calling bids this month for the clearing of Ruby Dam site and for construction of the dam, contractors were invited to inspect the site prior to the first snowfall. Ruby Dam, a Seattle municipal project, is to be located on the Skagit River, 150 miles northeast of the city.

Estimated costs are $300,000 for site clearing and $4,380,000 for dam construction. Bids will be separate. Later, proposals will be sought for construction of a $2,000,000 transmission line and $845,000 substation. PWA funds have been allotted, and the city has called for figures on a $5,500,000 bond issue.

Sale of $3,011,000 Seattle City Light Department bonds to a syndicate represented by Drumheller, Ehrlichman & White, of Seattle, was voted by the City Council Nov. 12. Proceeds will be consolidated with a Federal grant of $3,000,000 to help finance construction of Ruby dam and power plant, erection of transmission line, and extension of the Seattle distribution system.

The syndicate will take $2,511,000 of the bonds at an effective interest rate of 3.99 percent, and $500,000 at a rate of about 4.25 percent. The syndicate also was granted a six-month option on an additional issue of $2,489,000.

•

Utah P. & L. Gives Free Christmas Lighting

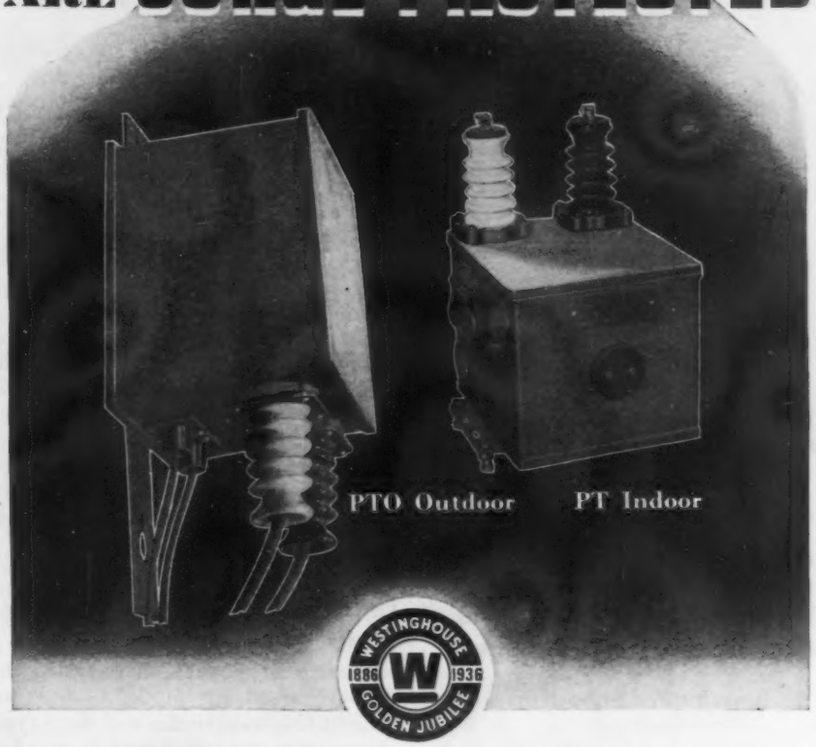
Pursuing its custom of several seasons, the Utah Power & Light Co. is again furnishing free energy for festoon, stringer and display Christmas lighting in the business districts of all communities which it serves. The service, which began Dec. 1, will continue until Jan. 3, according to President G. M. Gadsby.

Lighting service representatives of the company are cooperating with community committees in designing displays and connecting installations. The company does not furnish service for the illumination of any building, nor will it sell any equipmnet used in making the street displays.

•

• AGRICULTURAL POWER engineers and others interested in rural electrification will attend the annual rural electric short course at the College of Agriculture, Davis, January 11-13, 1937, sponsored by the California C.R.E.A. Subjects to be presented include electric fences, low-cost air conditioning, electric pig brooders, milk cooling, irrigation pumping costs, fruit and nut dehydration and electric insect traps. There will also be a demonstration of a small electric tractor.

THESE POTENTIAL TRANSFORMERS ARE SURGE-PROTECTED



DANGEROUS voltage surges never reach the windings of PT and PTO potential transformers. They are shunted to ground before they have a chance to do any harm. The bushings flash over before the coils are subjected to dangerous potentials.

This exclusive performance is assured by:

1—Winding the high-voltage coil on a Moldarta spool into the center of which is slipped the low-voltage coil wound on a Micarta spool. In addition, every part of the windings adjacent to the iron core is protected by Micarta channels.

2—A new plastic insulation that has the high dielectric characteristics of solid insulation and a dielectric strength well in excess of the combination of insulation and oil used in ordinary oil-insulated instrument transformers. Distinctly a Westinghouse development, this special insulation compound thoroughly impregnates the coils and entirely fills the sheet-metal cases of PT and PTO Potential Transformers.

Your Westinghouse representative will be glad to give you the many other outstanding advantages of these transformers. J 70028

Westinghouse

BRASS BUSHED
for greater strength

•

Hemingray Adds to its Long List of Advantages

1. Brass bushed smooth threads for insulator pin.
2. Greater mechanical strength.
3. Sustained high dielectric strength.
4. Unaffected by sudden temperature changes.
5. Withstand maximum insulator pin expansion.
6. Never age or deteriorate.
7. Controlled uniformity of product.
8. All surfaces impervious to moisture.
9. Tougher—withstand rough handling.
10. Clear and flawless for easy inspection.

Owens-Illinois Glass Company, Hemingray Division, Muncie, Ind.

HEMINGRAY
Glass
INSULATORS

San Joaquin District Goes 10 Years Without Accident

Ten years without a lost-time accident by Taft division of the San Joaquin Light & Power Corp. was the occasion for a dinner which assembled forty members of the company, including executives and department heads. Considered outstanding in accident prevention, the record was achieved during a period in which hundreds of miles of lines were constructed in the district's oil fields.

District Manager O. A. Kommers presided, with Rod McDonald acting as toastmaster. On the district's central accident committee are L. J. Fuller, G. W. Berryhill, E. L. Sword, J. M. Shoopman and Mr. Kommers.

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• FIRST PLACE in the first aid meet of the Utah-Nevada Safety Society this year went to the Salt Lake service department team of the Utah Power & Light Co., when they won in competition with twelve picked teams representing mining, smelting and steel companies, fire departments and public utilities. The team won first place in the A division (experienced teams), and was awarded the Jack Dempsey trophy for most accurate resuscitation. Harry McEwan was in charge of training.

•

Utah P. & L. Starts Series of Broadcasts

Variety of appeal characterizes the 1936-37 broadcasts of the Utah Power & Light Co., now on the air. Four types of programs are being used in an effort to reach many classes of listeners. Commercial announcements on lighting, cooking and small appliances are included. The schedule is:

KSL—Mon. and Wed., 9 a.m., home service
KSL—Sat., 7:30 p.m., "Pioneer Trails", western history (no commercial)
KDYL—Wed. and Fri., 6:45 p.m., "Friends O'Mine" life problems
KDYL—Fri., 10 a.m., old favorite songs
KLO—Mon., Wed. and Fri., "Stray Hollister of Vanishing Valley," western drama

•

• VOLUNTARY RATE reductions, which will save electric customers of the San Diego Consolidated Gas & Electric Co. nearly $100,000 a year, became effective Nov. 16. Gas rate reductions also were approved by the State Railroad Commission, bringing the total estimated reduction to $120,396 a year.

Distribution of the reductions is estimated as follows: commercial lighting, $57,655 in the cities of San Diego, Chula Vista, Coronado, El Cajon, Escondido, La Mesa, National City, Oceanside and San Clemente, and $3,735 in unincorporated territory; residential lighting, $30,762 for incorporated cities, and $3,550 in unincorporated territory; other reductions $3,106.

• A $1,000,000 REFRIGERATOR ORDER, largest of its kind ever placed, has been awarded to the Westinghouse Electric & Manufacturing Co. by Harold L. Ickes, PWA administrator. The 16,697 refrigerators are to be used in 34 PWA slum clearance and low rent housing projects located in 26 cities where electric rates make electric refrigeration economical. Deliveries will take place between January and October 1937. The units will be of standard 4-cu.-ft. cabinet design.

•

San Francisco May Vote On Municipal Distribution

A proposal that San Francisco issue $43,700,000 in revenue bonds to purchase the San Francisco distribution system of the Pacific Gas & Electric Co. may be placed before voters Feb. 16, 1937, provided action taken by the board of supervisors last month remains unchanged.

The revenue bond proposal is to finance plan 7 under which $39,000,000 would be used to purchase P.G.&E. facilities, the balance to construct the Red Mountain Bar power house, an office, and provide working capital.

At the same time, P. M. Downing, vice-president and general manager of P.G. & E., made the statement that the company shortly will reduce electric rates over a wide range of schedules. He denied the reductions have been influenced by the city's plans. This will be the second reduction in a little more than a year, rates having been reduced an average of 10 per cent late in 1935.

Two members of the city's board of supervisors have subsequently objected to proceeding until a check of estimated costs is made and have suggested negotiation with P.G. & E. in advance of an election.

Municipal distribution so far has been given precedence by the city over rapid transit. The latter problem, occasioned by traffic shifts due to the Bay bridges, has involved consideration of a $52,000,000 subway program. Supervisors believe the electorate would not approve both measures at the same election.

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• A SPECIAL ELECTION in Los Angeles, Dec. 8, was to determine a proposed charter amendment providing for the acquisition of the electric properties of the Los Angeles Gas & Electric Corp., and the granting of 35-year franchises to the three gas companies operating in the Los Angeles area. A price of $46,340,000 has been set for the corporation's electric properties, which when acquired by the city, would be absorbed into the municipal electric system.

So. Calif. Edison Plans To Receive Boulder Power

Construction of facilities for carrying Boulder Dam power to the Southern California Edison Co. system will start early in 1937, according to Fred B. Lewis, vice-president and general manager. Completion is set for July 1, 1938, two years ahead of the time required in the company's contract with the Federal government.

"Indications pointing to a continued rise in construction costs make it appear advisable to carry out this program ahead of schedule," says Mr. Lewis.

At a cost of $3,750,000, the company will build a 230,000-volt transmission line from Boulder Canyon to the company's Chino receiving station. The line, 238 miles long, will be designed to transmit 165,000 kw., and will be separated by 25 miles from other lines to Southern California.

At Chino station, new equipment will include 230,000/69,000-volt stepdown transformers, a 50,000-kva. condenser for voltage regulation, and switch racks.

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Funds Allotted for First All-American Unit

Permitting completion within a year, the PWA last month allotted $2,760,000, of this $1,242,000 by grant and $1,518,000 by loan, for construction of the first power unit on the All-American Canal. Allottment was made to the Imperial Irrigation District of El Centro, Calif.

The unit, to be located at site No. 4, where there is an available head of 47 ft., will have an installed capacity of 18,500 kw. This will eventually be doubled.

Authorized by the Boulder Canyon Project Act, the All-American Canal taps the Colorado River 15 miles north of Yuma, Ariz., flows westward for 80 miles along the Mexican border to Imperial Valley in California. Power development is incidental to irrigation of 1,000,000 acres of land. REA has allotted $700,000 to the district, but availability awaits approval of the project by popular vote.

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• UNDERGROUND CABLE will replace overhead lines of the British Columbia Electric Railway Co. along Georgia St. in Vancouver and out Boundary Road to the Horne Payne substation. The City Board of Works has approved. This is part of a $1,000,000 program proposed by the company. The program includes further undergrounding and erection of a new substation in the Grandview area.

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• APPLICATION of the Market Street Railway for a reduction in power rates from the Pacific Gas and Electric Co. has been denied by the California State Railroad Commission. In its order the commission pointed out that while industrial power use had approximately doubled and domestic use trebled since 1923, the power requirements of the street railway had declined 13 per cent in the same period.

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• A SPECTACLE for night visitors to Boulder Dam will be created by flood lighting the entire dam face and canyon wall outlets, according to plans announced by the Reclamation Bureau. Conduits are in place, and fixture installation, already started, will be completed in March.

Creations of Avocations

Originated by Ray Torrence, Sacramento chairman of the Pacific Service Employees Assn. of the Pacific Gas & Electric Co., was the employees' "Hobby Show." Model making, oil painting and stamp collecting are but a few of the variety of hobbies which contributed to the exhibit. After a showing in a State Fair Grounds building, a selected portion of the exhibit was moved to the above window of the company's 1100 K St. office

Underground Transmission

Without Conduit

Note the air and moisture proof flexible coverings. Sealtite represents a distinct advance in parkway cable construction. It is more pliable than any other underground cable . . . and costs are considerably lower.

Write for booklet offering suggested uses and explaining long life.

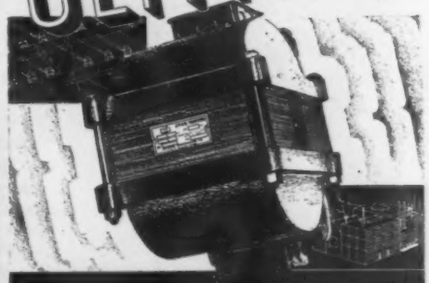
SEALTITE

Parkway and Airport Cable with Maximum Flexibility by

PROVIDENCE

MAYDWELL & HARTZELL
INCORPORATED
ELECTRICAL ENGINEERS
and
MANUFACTURERS' REPRESENTATIVES
Los Angeles ★ San Francisco

JEFFRIES



TRANSFORMERS

Save Their Cost and Pay Dividends by—

1. Elimination of duplicate conduit runs.
2. Saving in power rate.

(Put all of your 110-volt equipment on a 220-volt or 440-volt power circuit, it is economical.)

JEFFRIES TRANSFORMER COMPANY
5706 Long Beach Ave. Los Angeles

Bigger 1937 Load Predicted for W.W.P. Co.

Production in excess of one billion kilowatt hours is forecast for the Washington Water Power Co. in 1937 by J. E. Royer, vice-president and general manager. Also foreseen is a 10 to 15-per-cent increase in sales of electrical merchandise.

Output for the twelve months ending Oct. 31, amounted to 986,984,000 kw.-hr., representing both generated and purchased energy, an increase of 20 per cent over the previous twelve-month period.

Increased unit sales, but decreased income due to lower prices, is expected in appliance sales for the company and dealers throughout its territory. The company's estimate is $3,470,000, compared to $3,774,617 for the past year.

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• FOR CONSTRUCTION WORK at its upstream dam near Hirschdale, Calif., the Sierra Pacific Power Co. has constructed a 1¾-mile line from Boca. Pumps, compressors and lights will draw nearly 600 kw. Under construction are a 24-mi. line connecting Yerington and Schurz and a 2-mi. line connecting Norden and the Donner Summit station.

• OBJECTING TO THE EFHA plan for installment selling of electrical equipment, C. W. Koiner, city manager of Pasadena, said Pasadena will not enter into such agreement with the Federal government. Objections of the city were that such action would single out a line of merchandise in the sale of which the city was to become interested, that it would put the city into the position of encouraging its citizens to buy goods which they could not already afford to buy from local merchants, and that it would implicate the city in repossessing equipment. Los Angeles and Glendale have adopted the plan.

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• SIX FEATHER RIVER SITES on which the Pacific Gas & Electric Co. has asked permission to construct dams and power houses must remain undeveloped for at least six months, possibly a year, before action will be taken by the Federal Power Commission, according to FPC officials. The application seeks approval of six proposed units on the north branch of the Feather River, in Butte and Plumas Counties, between existing plants at Caribou and Big Bend. Generation, "for public utility purposes in northern and central California" would approximate 400,000 hp., it is estimated.

B. C. Electric Sponsors Farm Radio Program

To stimulate interest in farm use of electricity, the British Columbia Electric Railway Co. this winter will again conduct a series of radio farm talks. Sponsored by the company's agricultural division in conjunction with the extension department of the University of British Columbia, they will be broadcast each Monday for one hour over leading radio stations in Vancouver and at Chilliwack.

The first five talks will concern Great Britain and her farms, with particular attention to Canadian problems. Dean F. M. Clement of the university, will direct the lectures in collaboration with Prof. H. M. King, Dr. Blythe Eagles, and Prof. Robert England.

A new feature of the series will be a school of the air in which prize letter contests will be conducted. Complete information regarding these is contained in an illustrated syllabus of the lectures, which has been prepared by the company's agricultural department and is available free on request.

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Sierras Power Co. Prints Magazine for Customers

For its customers in the Imperial Valley, Southern Sierras Power Co. has started publication of a 16-page monthly magazine, *Valley Homebuilder*. Including editorial content of both local and world interest, the magazine is edited by H. R. Burton, assistant advertising agent.

To arouse reader interest, the magazine is sponsoring a contest, offering prizes for the best amateur photographs and for the best essays on historical subjects concerning the Imperial Valley. Many illustrations of modern, electrically-equipped homes are included.

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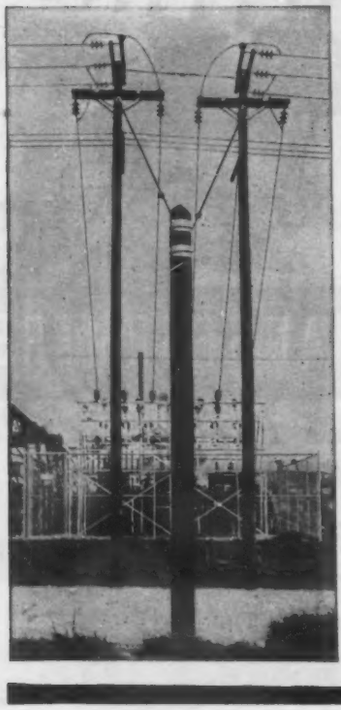
• ALLOTMENTS IN THE WEST for the construction of rural lines were announced by the Rural Electrification Administration as follows: to the Jefferson Valley Rural Electric Cooperative, Inc., Whitehall, Mont., $50,000 to build 49 miles of lines to serve 176 farms in Madison and Jefferson counties; to the Missoula County Electrification Assn., Missoula, Mont., $77,000 to build 73 miles of lines to serve 326 customers in Missoula and Ravalli counties; to the Public Utility District of Benton Co., Wash., $45,000 to build 43 miles of lines to serve 150 customers. The Grand Valley Rural Power Lines, Inc., of Grand Junction, Colo., was granted a loan contract for use of up to $140,000 to build 139 miles of rural lines to serve 638 customers in Mesa county.

Crapo
GALVANIZED PRODUCTS



Specified for Most Important Jobs

Crapo Galvanized Steel Strand has earned its reputation for longer life and lower maintenance cost by outstanding performances in actual service over a period of years.

It constantly is being specified for the most important construction jobs because of its ability to more than meet every requirement for strength, ductility and resistance to corrosion.

Crapo Galvanized Steel Strand and Wire is available in all standard grades and sizes.

Indiana Steel & Wire Company
Muncie, Indiana

(Left) New lines erected by Department of Water and Power, City of Los Angeles, and guyed with *Crapo* Galvanized Steel Strand.

Steel Strand

• • •

Telephone and Telegraph Wire

INDIANA STEEL & WIRE CO. MUNCIE, IND.

Northwest Association Sections Organize

Organization of three of the Northwest Electric Light and Power Assn. sections has been completed following meetings of the executive committees. All three sections have planned meetings in the spring of 1937.

George Wisting, Northwestern Electric Co., chairman of the Business Development Section, announced the appointment of the following bureau chairmen: residential sales, W. A. Huckins, Utah Power & Light Co.; commercial and industrial sales, A. K. Gaylord, Portland General Electric Co.; rural sales, S. J. Bowman, B. C. Electric Railway Co. The Section chose R. E. Gale, Idaho Power Co., to be vice-chairman.

The structure of the residential sales bureau was revamped with the formation of committees on home service and on home modernization. The first will consist of a home service or domestic lighting girl from each of the member companies and will be headed by Nancy Finch, Utah Power & Light Co. Walter E. Potter, Incandescent Lamp Department of General Electric Co., was named vice-chairman of the committee to take charge of the domestic lighting program at the annual meeting. The committee on Home Modernization will give consideration to ways and means of promoting all domestic appliances. It is headed by George W. Madison, Portland General Electric Co., chairman.

The commercial and industrial sales bureau was likewise simplified by division into but two committees. One general power committee will take up industrial heating, power, commercial cooking, air conditioning, and ventilation, with George Ellerbeck, Utah Power & Light Co., chairman. Commercial and industrial lighting is to be handled through a committee headed by George Bocarde, Pacific Power & Light Co. The rural sales bureau will function as a single unit.

The advertising committee, which was found so successful last year under the chairmanship of James Lightbody, B. C. Electric Railway Co., is to be continued under the same leadership, as a committee-at-large.

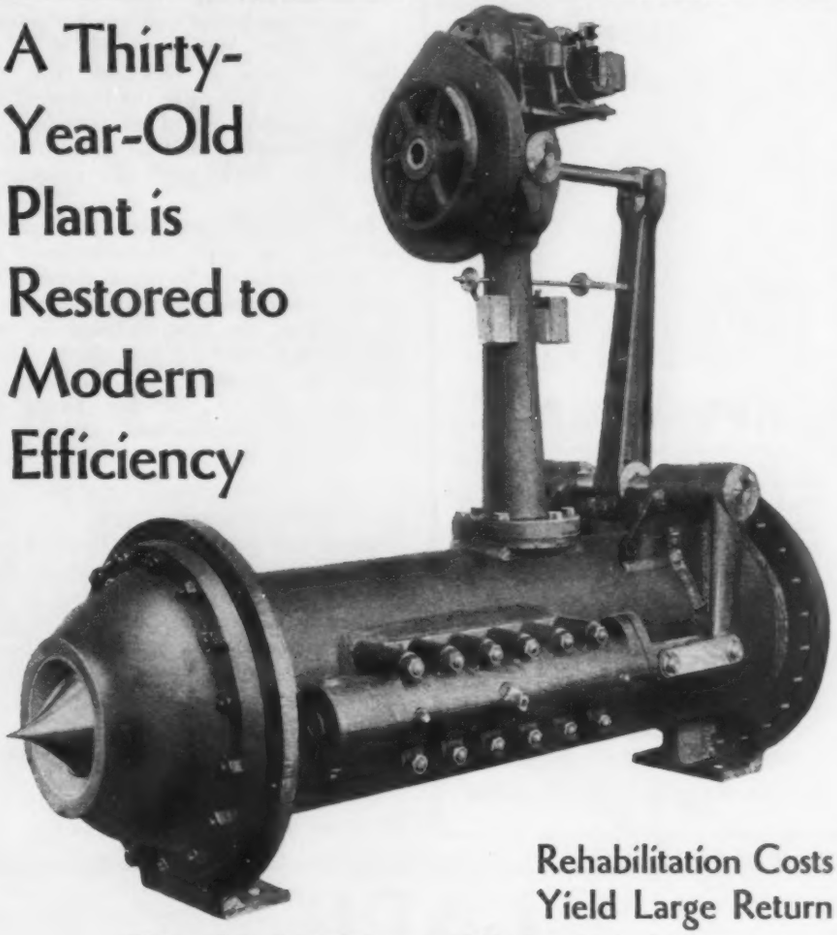
An innovation in the form of the annual meeting is to be tried this year. After a general session on the first morning, the meeting will break up into group meetings of the committees, reconvening as a general session on the second day to hear summary reports of these groups. The meeting is to be held in Salt Lake City, sometime in March.

Second to organize was the Engineering and Operation Section, under J. Hellenthal, Puget Sound Power & Light Co., chairman. Simplification was likewise effected in this organization by dropping the old general committee and giving some of the former sub-committees full committee standing. The following are the committees with their chairmen: production, E. H. Collins, The Washington Water Power Co.; transmission and distribution, E. F. Pearson, Northwestern Electric Co.; utilization, Paul P. Ashworth, Utah Power & Light Co.; accident prevention, J. D. Ellis, Northwestern Electric Co.; power systems engineering, H. H. Schoolfield, Pacific Power & Light Co.; code, M. T. Crawford, Puget Sound Power & Light Co. Mr. Crawford has recently been appointed an alternate on the electric light and power group of the Electrical Committee, N.F.P.A., to represent the utility companies of the Northwest.

The section will hold its annual meeting in Portland, April 22 to 24. T. A. Purton, Idaho Power Co., is vice chairman of the section.

The Accounting and Business Practice Section followed its custom of recent years in setting up no elaborate committee organization. Subjects will be assigned to individuals and will be developed by them with whatever aid is needed from representatives of other companies. Boise, Idaho, was selected as the place of the annual meeting and the dates were tentatively set at May 14-15. C. E. Gieseker, The Washington Water Power Co., was chosen Section vice-chairman.

A Thirty-Year-Old Plant is Restored to Modern Efficiency



Rehabilitation Costs Yield Large Return

This modern, high efficiency straight-flow nozzle, together with a runner of latest design, was practically all the hydraulic equipment needed for modernizing a thirty-year-old plant in California. From the standpoint of power output, operating cost, efficiency and safety, the modernized unit is far superior to the original installation, reconstruction costs having been comparatively insignificant.

Further details on this and other rehabilitated plants may be readily secured from Pelton engineers.

The Pelton Water Wheel Company

HYDRAULIC ENGINEERS

120 Broadway NEW YORK — 2919 Nineteenth St. SAN FRANCISCO — Paschall Station PHILADELPHIA

PELTON

...about People

Leslie W. W. Morrow Joins Corning Glass Works

Resigning after ten years as editor of *Electrical World*, Leslie W. W. Morrow has been appointed general manager of the new Fibre Products Division of the Corning Glass Works. He will be located at Corning, N.Y.

Mr. Morrow graduated in mechanical engineering at Cornell in 1911. He taught there until 1913, was director of the school of electrical engineering at the University of Oklahoma from 1913 to 1918, and in 1918 joined the faculty of Sheffield Scientific School at Yale. In editorial work since 1921, Mr. Morrow became editor of *Electrical World* in 1926.

The author of two books and numerous articles, Mr. Morrow is well known throughout the industry. Besides affiliation with several honorary societies he is a director of the A.I.E.E., vice-president of the Thomas Alva Edison Foundation and an executive committeeman of the Engineers' Council for Professional Development. He is also a member of the A.S.M.E. and the American Electrochemical Society.

•

Death Takes C. A. Maydwell

Among the last of California pioneers, Charles Allen Maydwell died at Providence Hospital in Oakland, Nov. 10. He was well known in the electrical industry, having served as president of the Maydwell-Hartzell Co. from its formation in 1923, until his retirement last year.

Mr. Maydwell was born in England in 1853. He went to Sacramento in 1876, and was associated there with Carlos Huntington and Mark Hopkins in building the first railroad in the State. Surviving are his widow, Mrs. Edan B. Maydwell of Oakland, a daughter, Mrs. E. Weldon Young of Seattle, and a brother and sister.

•

• WESTERN APPOINTMENTS for the General Electric Contracts Corp. were announced last month. F. H. Denslow received appointment as manager of the Pacific Coast district, replacing J. C. Saur, who has been appointed Chicago district manager. H. Garfinkel has been transferred from Seattle to managership of the local Los Angeles office. E. R. Surface has been advanced to Seattle local manager. H. P. Gough has been placed in charge of the recently established office for the Rocky Mountain territory at Salt Lake City.

• A. EMORY WISHON, president of the San Joaquin Light & Power Corp., and vice president of the Pacific Gas & Electric Co., last month was elected to the board of directors of the P. G. & E. Elected at the same time was Silas H. Palmer, formerly president of Palmer & McBride, contracting firm. The two succeed the late Guy C. Earl and the late John O'Brien.

•

• L. M. "MONTE" WATSON returned to the Pacific Coast as lighting division representative of the Cleveland Works, Westinghouse Electric & Manufacturing Co., with headquarters at 420 South San Pedro St., Los Angeles. Mr. Watson was in southern California beginning in 1919 until 1933 when he took a three-year leave of absence to enter government work. In 1936 he returned to the Cleveland factory and now has been returned to the Pacific Coast.

•

• WILL H. FISHER, vice-president of the Southern California Edison Co., has been appointed a vice-president of the newly organized Farm Chemurgic Council organized under the sponsorship of the California State Chamber of Commerce for the purpose of studying the relationship between industry and agriculture.

•

• F. O. DOLSON, vice-president and general manager of Southern Sierras Power Co., is back in Riverside after a three-month vacation in Europe. He stated that while he found European conditions improved over those during his previous visit, they still are comparable only to what would be considered poverty in America.

•

• A. H. NICOLL, Graybar manager at San Francisco, celebrated his twenty-fifth year with the company during the last month. L. O. Fryer, district merchandise manager, was host at a party commemorating the event at the San Francisco Olympic Club on November 16.

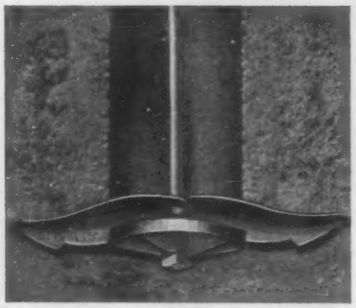
•

• LELAND D. O'CONNELL has been appointed manager of the Denver office of the Westinghouse Electric and Manufacturing Co. William Trudgian, former manager of the office, has been promoted to special representative. Mr. O'Connell has been with the Westinghouse organization since 1919.

•

• J. DEPPE, salesman for General Electric Supply Co., Los Angeles, for many years, recently joined the Central Arizona Light & Power Co. at Phoenix in the sales promotion division of that company.

JAMES B. KEARNEY CORPORATION ST. LOUIS, MO.



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Made of certified malleable iron—expands 2½ times its rated size—63% contact in firm, undisturbed earth—easily installed—maximum holding power.

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Electrical Engineers and Manufacturers' Representatives

Los Angeles ★ San Francisco

LAPP
LINE POST INSULATORS

Lapp Line Post Insulators eliminate radio interference due to both dirt and electro-static conditions.

★

Write for Bulletin No. 123 describing and cataloguing these insulators.

LAPP INSULATOR CO., Inc.
Le Roy, N. Y.

Los Angeles MAYDWELL & HARTZELL INCORPORATED San Francisco

★ *Electrical Engineers and Manufacturers' Representatives* ★

• A. E. CARTER, Vancouver electrical engineer, has been engaged for a six months period by the city council at Penticton, B.C., for the purpose of making a check on the condition of the municipality's power system and also to ascertain whether present equipment is causing power loss.

•

• HAL A. GARDNER has been appointed representative in San Francisco for the Pittsburgh Reflector Co. Mr. Gardner was for 10 years with the Puget Sound Power & Light Co., and is an electrical engineering graduate of the University of Washington. Following his return from the company's head office in Pittsburgh, he will establish San Francisco headquarters.

•

• ALSTON RODGERS, prominent in the General Electric Incandescent Lamp Division headquarters at Nela Park, Cleveland, has now been transferred to the South Pacific Division as illuminating engineer for southern California with headquarters at Los Angeles. Mr. Rodgers will be remembered for his part in the traveling show of the lamp division which toured the Pacific Coast last year.

•

• L. C. NICHOLS, since 1915 electrical engineer in charge of the transformer section of Allis-Chalmers Manufacturing Co., electrical division, died Nov. 3. Mr. Nichols was born at Westminster, Mass., 58 years ago. He had numerous inventions to his credit, was a fellow of the A.I.E.E., and a member of the N.E.M.A. board of governors.

•

..about the Trade

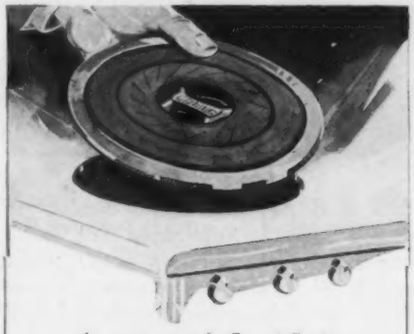
• WILL H. DAVIE, president Allied Industries, Inc., announced that effective Nov. 1 the executive offices of the firm were moved from San Francisco to the Los Angeles office at 451-59 South Hewitt St. The complete sales force, warehouse and stocks will be retained at the San Francisco address. Only office matters, such as remittances, statements and those pertaining to corporation affairs, will be handled in Los Angeles, which is the residence of Mr. Davie. Allied Industries are manufacturers' representatives with offices in Los Angeles, San Francisco, Portland and Seattle.

•

• NEWARK SAFETY COUNCIL recently made awards to two divisions of the Westinghouse Lamp Co., Bloomfield, N. J., for noteworthy safety performance. The large lamp departments received recognition for a total of 814,716 man-hours worked in the twelve months to June 30 without a disabling accident, the engineering department for no disabling accidents over a two-year period with an exposure of 556,926 man-hours.

•

• PARTNERSHIP in the Vancouver Electric Co. has been registered at Vancouver, B. C., by Noel Ethell and Albert W. Edwards. The firm is engaged in the electrical contracting business at Vancouver.



A powerful aid in electric range sales

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***Super-Speed* RANGE UNITS**

Sell ranges equipped with these units, and boost sales with the vital and exclusive advantages they offer. Use these units for replacement too, in other ranges—they fit all ranges—no big stocks necessary. Write us or our nearest representative.

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FOR

- *Lasting Economy*
- *Strength*
- *Safety*

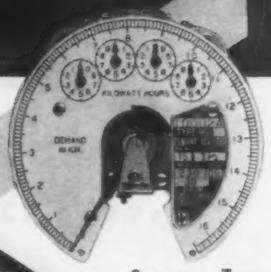
USE

LOCUST PINS
Oak Brackets and Pole Steps

LOCUST PIN CO. FRONT ROYAL, VA.

MAYDWELL & HARTZELL
INCORPORATED
Los Angeles ★ San Francisco

Use Up-to-date MAXIMUM DEMAND REGISTERS on



Sangamo Type HG Maximum Demand Register

MODERN METERS

Sangamo Type L-2-A Two-Element, Single-Disk Meter equipped with Type HG Demand Register

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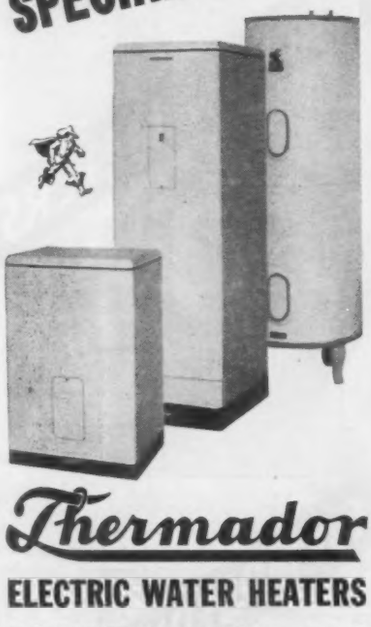
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Backed by

20 YEARS OF PROGRESS and SPECIALIZATION



Thermador

ELECTRIC WATER HEATERS

THERMADOR is one of the nation's pioneers in the building of electric water heaters. For twenty years, each season has witnessed a new THERMADOR line, each an advancement over the preceding one. Today, THERMADOR offers its twentieth Anniversary models, the smartest, most efficient electric water heaters in history.

The electric water heater business is booming in the West . . . and THERMADORS are leading the sales parade. Get your share of this business. Write at once for complete price lists and descriptive literature on Thermador room and water heaters.

"Seven Leagues Ahead"

Thermador Electrical Mfg. Co.

Factory: 2821 East Pico Blvd., Los Angeles
557 Market St., San Francisco
Builders Exchange, Fresno

• GEORGE H. CURTISS is representing the S & M Lamp Co.'s Flood-Lite division in northern California. His headquarters are 420 Market St., San Francisco.

•

• KIMBALL UPSON Co., 1030 K St., Sacramento, has been named distributors in northern California for Automatic washers and ironers.

•

• TERMINAL ELECTRIC Co., Portland, Ore., recently moved to larger quarters at 8506 North Jersey St.

•

• NEWMAN RADIO AND ELECTRIC Co., Portland, Ore., recently opened a new store at 2041 Southeast Powell Blvd.

•

• STONE-RYALS ELECTRIC Co., of San Francisco, motor and industrial contractors and designers of industrial machinery, announce their appointment as distributors in northern California and Nevada for the Shepard-Niles Crane & Hoist Co., of Montour Falls, N. Y., makers of industrial cranes and hoists.

•

• ASSOCIATED WHOLESALE ELECTRIC Co., 1111 Santee St., Los Angeles, Calif., announces its appointment as exclusive distributor for southern California by the Crosley Radio Corp. for refrigerators, radios and washing machines. According to C. D. Russell, general manager, the firm has also been appointed exclusive distributor for southern California on the Magic-Aire cleaners, manufactured by the Cleveland Suction Cleaner Co., Cleveland,

•

• BAKER SALES Co. has opened in Huntington Park, Calif., at 6114 Pacific Blvd. T. Baker, proprietor, formerly operated a similar electrical appliance store in New York.

•

• LINCOLN ELECTRIC Co. has increased its San Francisco office space 50 per cent in moving from 894 to 866 Folsom Street.

•

• DILSAVER ELECTRIC Co. is a new appliance shop at 234 East Manchester Ave., Los Angeles, formerly known as Larson & Dilsaver. P. C. Dilsaver has taken over the interests of Mr. Larson.

•

• CLAUSON'S WASHING MACHINE SHOP, which formerly operated at 328 Orange St. and later at 311 West Colton Ave., Redlands, Calif., has moved to a new store at 870 West Holt Ave., Pomona, Calif.

•

• A NEW APPLIANCE STORE has been opened at 2108 W. Central Ave., Newport Beach, Calif., by W. Fred Stohl.

• QUALITY ELECTRIC Co., LTD., industrial electrical contractors and motor specialists of Los Angeles, found it necessary to move to larger quarters at 1235 Olympic Blvd. (formerly Ninth Street) from its former address on South San Pedro St.

•

• MISSION ELECTRIC Co. managed by Paul P. Telfer is a new organization at 1315 N. Mission Rd., Los Angeles, carrying a wide line of radios and appliances.

•

• ELMER F. SHEETS ELECTRIC APPLIANCES has opened at 117 East Commonwealth Ave., at Fullerton, Calif. For the past 8 years Mr. Sheets has been with the appliance division of the Southern California Edison Co., Ltd.

•

• B & G APPLIANCE Co. has opened at 213 N. Broadway, Santa Ana, Calif., under proprietorship of R. D. Baker and E. B. Graiewski, carrying a complete line of Hotpoint heaters and G. E. appliances.

•

• NORMAN B. NEELY, 1656 North Serrano St., Los Angeles, has been appointed representative in southern California, Utah and Nevada for the Standard Transformer Corp. of Chicago.

MAYDWELL

Glass Insulators

All Standard Numbers For All Purposes

Made of high quality materials in a modern Pacific Coast plant producing an unusually tough glass to withstand all severe service conditions.

MAYDWELL & HARTZELL
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Electrical Engineers and Manufacturers' Representatives

Los Angeles ★ San Francisco

In New Equipment

Western Range Manufactured

Manufacture of a line of electric ranges and an electric water heater has been started by the new Woolwine Co., 5119 So. Riverside Drive, Los Angeles. Number one in the range line is the Beverly Hills, illustrated. It lists at $189.50. Embodying all modern features it has a 44x21-in. cooking top with four Spede-Grid surface units. Finish is in white or ivory. Carrying the same surface units, a 41x21-in. cooking top and large baking and warming ovens is the Malibu at $89.50.

●

Long-Service Automobile Battery

A guarantee for "as long as the purchaser owns his car" will be carried by a battery for automobiles to be introduced by the Kathanode Corp. To increase battery life, the positive plates are covered with flexible, porous mats of spun glass, which prevent lead particles from falling off, yet admit a free supply of electrolyte. Cells 24 per cent larger than standard are permitted through changes in container design.

●

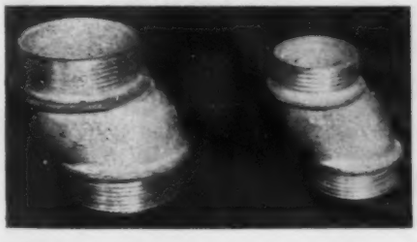
French Fryer

Doughnuts, french fried potatoes, fritters and a variety of other delicacies now can be cooked electrically in a new appliance, the Marion "400" Deep Fryer, manufactured by the Rutenber Electric Co., Marion, Ind. Specifications are size 19½ x 8½ x 6½-in., weight 10 lbs. 4 oz., 115 volts, 1,600 watts. The fryer is thermostatically controlled, and the fat pan can be transferred to the icebox when cooking is completed, eliminating the handling of hot fat.

●

Utility Nipple

An offset nipple which permits mounting of switches, gutter outlet boxes and other equipment where knockouts don't line up is being manufactured by B. Hartman, 168 Sunset St., Long Beach, Calif. Sizes available are ½, ¾, 1¼ and 2 in. All are the same length, 1⅝ in. between shoulders.



Combination Lighting Fixtures

A ventilated diffuser, combining light from a 250-watt mercury lamp and one 300-watt or two 150-watt incandescent lamps, has been announced by Benjamin Electric Manufacturing Co. The fixture allows sufficient cooling of the mercury lamp in case of a current interruption to assure restarting, even though the incandescent units remain burning. A porcelain enameled steel dome type reflector and an opal glass diffusing globe are augmented by a reflector within the hood to assure maximum light utilization.

●

Heatfan by Thermador

For year-round use, Thermador Electrical Manufacturing Co., Los Angeles, has introduced the "Heatfan", a combination heater and fan unit to retail at $12.50. It is 12 in. high, weighs 7½ lb. Equipped with a 4-blade fan, it operates on 115 volts a.c., 50-60 cycles. It draws 1,650 watts when heating, is equipped with two switches for warm and cool air.

●

Speedy Mixer

Variable speed instead of definite speed steps is offered in the new Hamilton Beach food mixer, Model D. The portable motor lifts off the stand with one hand, and the single switch control can be operated with the same hand. Attachments that were used with Models B and D, fit the new model, which is priced to sell in the West for $20.90.

●

Portable Testing Box for Relays

Distance, reactance or impedance relays may be tested in the field by one man with a new portable testing box announced by General Electric Co. The unit weighs 15 lb.; dimensions are 9x10x7½ in. when closed. It is used with external resistors and reactors which are also portable. No phase angle meter is necessary, and the only calculation needed is multiplication of the fault reactance by a dial setting. As the setting of the relay is not based on the readings of instruments, errors of reading or calibration are eliminated.

Streamlined Mixmaster

Streamlined design and maintenance of full power at all speeds, to prevent slowing down when batter thickens are features of the new Sunbeam Automatic Mixmaster announced by the Chicago Flexible Shaft Co.

●

Square D Breaker-Panels

To sell at low cost, only slightly higher than equivalent fused units, are the new multi-breaker lighting panelboards announced by Square D Co., Detroit, Mich. Compactness, 15 in. wide, 4 in. deep, permits installation in space otherwise prohibitive. Trimmed in brown and tan with exterior hardware chromium plated, the panelboards are supplied with from 4 to 40 circuits in two-circuit groupings for 115, 115/230 volts a.c. Mains can be arranged for 3-wire solid neutral or 3-phase, 4-wire systems. Single pole branches are obtainable for 15, 20, 25 or 50 amp. Circuit designations and a directory card are provided.

●

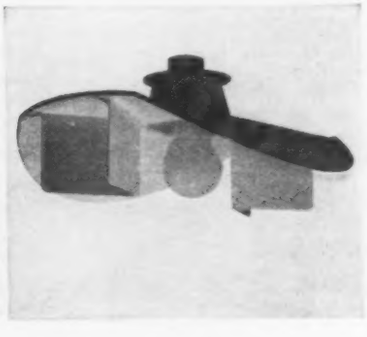
Electric Marker Writes on Glass

A portable electric marker, which will mark on glass as well as hard steel, ceramics and plastics, has been introduced by the Ideal Commutator Dresser Co., Sycamore, Ill. The instrument is 6¾ in. overall and weighs 2 lb. Equipped with a 6-ft. cord with plug and on-off switch, it is normally furnished for 110 volts, 60 cycles, consuming about 75 watts, but is available for other voltages and frequencies.

●

Reflector for Bins

To concentrate light on the vertical and horizontal surfaces of bins and stacks is the purpose of a new luminaire announced by the Westinghouse Electric and Manufacturing Co. It consists of a reflector and socket cover, with socket. Two triangular vanes are located opposite each other to cut off light along aisles and direct more light to the working plane. The reflector sides are dipped down to redirect light into the bins and cut off stray.



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G.C.A.

Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 20 years

The G. C. A. Manufacturing Co.
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Air Conditioning
Frigidaire Corp.
General Elec. Co.
Graybar Elec. Co., Inc.
Kelvinator Corp.

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Bristol Co.
General Elec. Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instr. Corp.

Anchors, Guy
A. B. Chance Co.
Hubbard & Co.
James R. Kearney Corp.

Anchor and Guy Rods
A. B. Chance Co.
General Elec. Co.
Hubbard & Co.
Maydwell & Hartzell, Inc.

Appliances, Household
Edison Gen. Elec. Appliance Co., Inc.
General Elec. Co.
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Lindemann & Hoverson Co., A. J.
Malleable Iron Range Co.
McGraw Elec. Co.
National Enameling & Stamping Co.
The Silex Co.
Waters-Genter Div.
Westinghouse Elec. Supply Co.

Belts, Safety Straps, Pole Climbers
Western Hardware & Tool Co.

Boxes
General Cable Corp.
General Elec. Co.
Superior Switchboard & Devices Co.

Brackets, Wood
Locust Pin Co.

Breakers

Air Circuit Breakers
General Elec. Co.
I-T-E Circuit Breaker Co.
Roller-Smith Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.

Oil Circuit Breakers
Allis-Chalmers Mfg. Co.
Delta-Star Electric Co.
General Elec. Co.
Pacific Elec. Mfg. Corp.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Bus Fittings
Burndy Eng'g Co.
General Elec. Co.
Pacific Elec. Mfg. Corp.

Buses
Aluminum Co. of America

Cable Accessories
General Cable Corp.
General Elec. Co.
John A. Roebling's Sons Co.

Cables
Aluminum Co. of America
American Steel & Wire Co.
Columbia Steel Co.
Crucible Steel Co. of America
General Cable Corp.
General Elec. Co.
Graybar Elec. Co., Inc.
Maydwell & Hartzell, Inc.
National Elec. Products Corp.
The Okonite Co.
Okonite-Callender Cable Co.
Providence Insulated Wire Co.
Rockbestos Products Corp.
John A. Roebling's Sons Co.
United States Steel Corp.
Westinghouse Elec. & Mfg. Co.

Carbon Brushes
National Carbon Co., Inc.

Carbon Products
National Carbon Co., Inc.

Chimes
Square D Co., Inc.

Coffee Makers
The Silex Co.

Coil Winding
Jeffries Transformer Co.

Commutator Dressers
Ideal Commutator Dresser Co.

Compounds, Insulating
Clifton Mfg. Co.
General Cable Corp.
General Elec. Co.

Condensers, Electric
Allis-Chalmers Mfg. Co.
General Elec. Co.
Westinghouse Elec. & Mfg. Co.

Conduit
Aluminum Co. of America
General Elec. Co.
Youngstown Sheet & Tube Co.

Conduit, Underground
Fire Proof Wall Co.
Johns-Manville Corp.

Connectors
Burndy Eng'g Co.
James R. Kearney Corp.

Controllers
Allis-Chalmers Mfg. Co.
General Elec. Co.
Square D Co.
Westinghouse Elec. & Mfg. Co.

Cutouts
James R. Kearney Corp.
General Elec. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Demand Control
General Elec. Co.
Wesix, Inc.

Distribution Specialties
General Elec. Co.
Hubbard & Co.
James R. Kearney Corp.
Maydwell & Hartzell, Inc.
St. Louis Malleable Casting Co.
Superior Switchboard & Devices Co.

Electrodes, Arc Welding
John A. Roebling's Sons Co.
General Elec. Co.

Enclosures, Meter and Instrument
Superior Switchboard & Devices Co.

Fans
General Elec. Co.

Farm Electrification Equipment
General Elec. Co.

Fittings, Conduit
General Elec. Co.

Fittings, Insulator
Brewer-Titchener Corp.

Fixtures, Lighting
Benjamin Elec. Mfg. Co.
General Elec. Co.
Pittsburgh Reflector Co.
Smoot-Holman Co.
Westinghouse Elec. & Mfg. Co.

Floodlighting
Crouse-Hinds Co.
General Elec. Co.
Pittsburgh Reflector Co.
S & M Lamp Co., Inc.
Smoot-Holman Co.
Westinghouse Elec. & Mfg. Co.

Flumes
California Corrugated Culvert Co.
R. Hardesty Mfg. Co.
Pure Iron Culvert & Mfg. Co.
Washington Corrugated Culvert Co.
Western Metal Mfg. Co.

Gasoline
Union Oil Co.

Gates
California Corrugated Culvert Co.
R. Hardesty Mfg. Co.
Pure Iron Culvert & Mfg. Co.
Washington Corrugated Culvert Co.
Western Metal Mfg. Co.

Generators
Allis-Chalmers Mfg. Co.
General Elec. Co.
Westinghouse Elec. & Mfg. Co.

Graphite Products
National Carbon Co., Inc.

Ground Rods
Maydwell & Hartzell, Inc.

Heaters, Air
Edison Gen. Elec. Appliance Co.
Noblitt-Sparks Industries, Inc.
Thermador Elec'l Mfg. Co.
Wesix Inc.
Edw. L. Wiegand Co.

Heaters, Water
Edison Gen. Elec. Appliance Co.
Fowler Mfg. Co.
Lindemann & Hoverson Co., A. J.
Malleable Iron Range Co.
Standard Elec. Stove Co.
Thermador Elec'l Mfg. Co.
Wesix Inc.
Westinghouse Elec. & Mfg. Co.

Heating Element—Repair Part
Edw. L. Wiegand Co.

Instruments, Measuring and Recording
See Ammeters, Voltmeters, Wattmeters.

Insulation
General Elec. Co.
Johns-Manville Corp.
Ohio Brass Co.

Insulators
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Corning Glass Works
Graybar Elec. Co., Inc.
Hemingray Glass Co.
Geo. E. Honn Co.
Lapp Insulator Co., Inc.
Maydwell & Hartzell, Inc.
Ohio Brass Co.
Owens-Illinois Glass Co.
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General Elec. Co.
Savage Distributing Co.

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Faries Mfg. Co.
General Elec. Co.
Lumidor Mfg. Co., Inc.

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General Elec. Co.
Westinghouse Lamp Co.

Lamps, Student
Lumidor Mfg. Co., Inc.

Lamps, Sun
General Elec. Co.

Lighting Equipment
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Crouse-Hinds Co.
Faries Mfg. Co.
Smoot-Holman Co.
Westinghouse Elec. & Mfg. Co.
Wuelker Reflector Mfg. Co.

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Ohio Brass Co.

Meters
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General Elec. Co.
L. A. Nott
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec'l Instrument Corp.

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Westinghouse Elec. & Mfg. Co.

Motor Starters
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General Elec. Co.
Square D. Co., Inc.
Westinghouse Elec. & Mfg. Co.

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Union Oil Co.

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General Elec. Co.
Union Oil Co.

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Square D Co., Inc.
Superior Switchboard & Devices Co.
Westinghouse Elec. & Mfg. Co.

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Weston Elec'l Instrument Corp.

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Locust Pin Co.

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★ CIRCUIT BREAKERS (Air and Oil)
★ INSTRUMENT AND CONTROL SWITCHES
★ SWITCHGEAR
★ RELAYS

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Where to Buy It in the West—*Continued*

Pole Line Hardware
Brewer-Titchener Corp.
General Electric Supply Corp.
Graybar Electric Co., Inc.
Hubbard & Company
Joslyn Co. of California
Kortick Mfg. Co.
Maydwell & Hartzell, Inc.

Porcelain
Standard Elec. Porcelain Mfrs.

Public Utilities
California Oregon Power Co.
Idaho Power Co.
Mountain States Power Co.
Northwestern Electric Co.
Pacific Gas and Electric Co.
Pacific Power & Light Co.
Portland General Electric Co.
Puget Sound Power & Light Co.
San Diego Cons. Gas & Elec. Co.
San Joaquin Light & Power Corp.
Southern California Edison Co. Ltd.
Utah Power & Light Co.
Washington Water Power Co.

Pullers, Slack
A. B. Chance Co.

Pumps
Pelton Water Wheel Co.

Range Units
Edison Gen. Elec. Appliance Co.
Edwin L. Wiegand Co.

Ranges
Edison Gen. Elec. Appliance Co.
General Elec. Co.
General Elec. Supply Corp.
Kelvinator Corp.
Lindemann & Hoverson Co., A. J.
Malleable Iron Range Co.
Standard Elec. Stove Co.
Steiger & Kerr Stove & Fdry. Co.
Walker & Pratt Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Reflectors
Benjamin Elec. & Mfg. Co.
Pittsburgh Reflector Co.
Smoot-Holman Co.
Westinghouse Elec. & Mfg. Co.
Wuelker Reflector Mfg. Co.

Refrigerators
Frigidaire Corp.
General Elec. Co.
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Kelvinator Corp.
Leonard Refrigerator Co.
Malleable Iron Range Co.
Westinghouse Elec. & Mfg. Co.

Relays
General Elec. Co.
Hart Mfg. Co.
Roller-Smith Co.
Square D Co., Inc.

Rheostats & Resistors
General Elec. Co.
Westinghouse Elec. & Mfg. Co.

Roasters
National Enameling & Stamping Co.
Westinghouse Elec. & Mfg. Co.

Rolls, Wringer
Lovell Mfg. Co.

Rural Line Hardware
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Hubbard & Co.
Joslyn Co. of Calif.
Kortick Mfg. Co.
Maydwell & Hartzell, Inc.

Service Organizations
Crocker First National Bank
Elec'l Testing Labs.
McGraw-Hill Book Co.
Northwest Elec. Light & Power Association
Pacific Coast Elec'l Ass'n
Pacific Coast Elec'l Bureau

Strand, Guy
Maydwell & Hartzell, Inc.
Pacific Wire Rope Co.

Street Lighting Fixtures
General Elec. Co.
Graybar Elec. Co., Inc.
Hubbard & Co.
Westinghouse Elec. & Mfg. Co.

Switchboards
Allis-Chalmers Mfg. Co.
General Elec. Co.
Roller-Smith Co.
Square D. Co., Inc.

Switches, Disconnect
Delta-Star Electric Co.
General Elec. Co.
Kearney Corp., James R.
Pacific Elec. Mfg. Corp.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Switches, Fuse
General Elec. Co.
Kearney Corp., James R.
Schweitzer & Conrad, Inc.

Switches, Heater
Bryant Elec. Co.
General Elec. Co.
Hart Mfg. Co.

Switches, High Tension
James R. Kearney Corp.

Switches, Meter Test
General Elec. Co.
Meter Devices Co.
Square D Co., Ins.
Superior Switchboard & Devices Co.

Switches—Pressure and Temperature
The Bristol Co.
Hart Mfg. Co.
Square D Co., Inc.

Switches, Safety
Colt's Patent Fire Arms Mfg. Co.
General Elec. Co.
Square D Co., Inc.
Westinghouse Elec. & Mfg. Co.

Switches, Thermostat Controlled
Colt's Patent Fire Arms Mfg. Co.
General Elec. Co.
Hart Mfg. Co.
Thermador Elec'l Mfg. Co.

Switches, Time
General Elec. Co.
Sangamo Elec. Co.

Switchgear
Allis-Chalmers Mfg. Co.
Delta-Star Electric Co.
General Elec. Co.
I-T-E Circuit Breaker Co.
Westinghouse Elec. & Mfg. Co.

Tapes—Friction and Rubber
Clifton Mfg. Co.
Geo. E. Honn Co.

Telephone & Telegraph Hardware & Specialties
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Hubbard & Co.
Maydwell & Hartzell, Inc.

Telephone Systems—Private
American Automatic Elec. Sales Co.

Terminals, Cable
General Cable Corp.
General Elec. Co.

Testing Devices
Superior Switchboard & Devices Co.

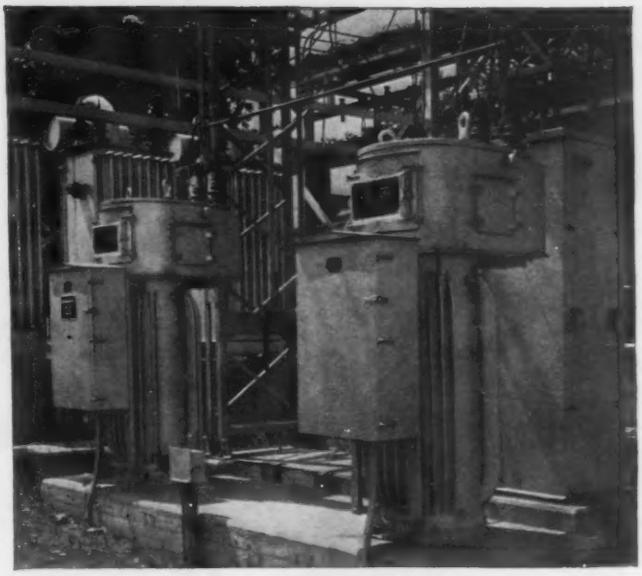
Tools, Live Line
A. B. Chance Co.
James R. Kearney Corp.
Western Hardware & Tool Co.
Sangamo Elec. Co.

Transformers
Allis-Chalmers Mfg. Co.
Gardner Elec. Mfg. Co.
General Elec. Co.
Jeffries Transformer Co.
Western Transformer Co.
Westinghouse Elec. & Mfg. Co.

Tubing, Elec'l Metallic
Aluminum Co. of America

Turbines
Pelton Water Wheel Co.

Valves
Ohio Brass Co.
Pelton Water Wheel Co.



Excellent Service at a Profit—

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The desirability of maintaining correct voltage levels can hardly be overestimated—particularly in the face of rapidly increasing loads. Voltage regulation offers a twofold advantage. To utility customers, electric service delivered at the correct voltage means the maximum return for each dollar invested in light, heat, or power. To the operating company, it provides an opportunity further to improve service at substantial savings over other methods of producing equivalent results.

The G-E station-type induction regulators illustrated are maintaining the proper voltage levels; at the same time, it is conservatively estimated that they are returning 24 per cent on the investment annually, a saving sufficient to pay for the cost of the improved service in a little more than four years.

The complete line of G-E regulating equipment makes it possible to regulate voltage *accurately* on any part of the system with the minimum of capital investment. There is a G-E regulator for every need—for all areas, for all load densities. For a complete description of G-E regulators, ask for Folder GES-1142A. General Electric, Dept. 6C-201, Schenectady, N. Y.

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★ Increasing application over a constantly broadening field is convincing evidence that a product is giving satisfaction. Sales of SA Series Grades continue their rapid growth. The range of service in which these grades have established superiority is steadily expanding. They DO give satisfaction.

★ SA Series Grades are the product of an exhaustive research program which determined and incorporated in this product the characteristics essential to satisfactory performance on commutating equipment. For this reason, they are uniform in *performance* as well as in *physical characteristics*.

PROVE THEIR SUPERIORITY BY A TRIAL!

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General Elec. Co.
Little Giant, Inc., Ltd.
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Wattmeters
Bristol Co.
General Elec. Co.
L. A. Nott
Roller-Smith Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Corp.

Water Wheels
Pelton Water Wheel Co.

Wire
Aluminum Co. of America
America Steel & Wire Co.
Columbia Steel Co.
Crescent Ins. Wire & Cable Co.
Crucible Steel Co.
General Cable Corp.
Hazard Ins. Wire Works
Keystone Steel & Wire Co.
National Elec. Products Corp.
The Okonite Co.
Providence Insulated Wire Co.
Rockbestos Products Corp.
United States Steel Corp.
Westinghouse Elec. Supply Co.

Wiring Supplies
Associated Sales Engineers
Bryant Electric Co.
Crouse-Hinds Co.
Gen. Elec. Supply Corp.
Graybar Elec. Co., Inc.
General Elec. Co.
Graybar Elec. Co., Inc.
Hart Mfg. Co.
Indiana Steel & Wire Co.
Maydwell & Hartzell, Inc.
Pacific Wire Rope Co.
John A. Roebling's Sons Co.
Westinghouse Elec. & Mfg. Co.

Wringer Rolls
Lovell Mfg. Co.

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A Story of

Three little tables

THE incident about to be related is absolutely true. It is one of several cases we know of where furniture and department store people have suddenly discovered the tremendous sales potentialities in small electric appliances.

IT HAPPENED about this time last year. A certain P. G. and E. dealer-man was talking to a department manager of a leading San Francisco store. They got on the subject of Christmas business and our man remarked:

"You know, Bob, if I were you I'd give better display space to small electric appliances.

"They're *bright* and *colorful*—they *look* Christmas-y.

"On top of that, they're practical, *useable*.

"And they're certainly *right* as far as price is concerned.

"If your customers were exposed to these appliances—if they could handle them and get the feel of them, I think you'd be surprised at the turn-over.

"Get up a real bang-up display on a good, busy aisle. Let the merchandise sell itself. It will, I promise you".

TWO MONTHS LATER. Same man talking: "Well, Bob, what kind of a Christmas did you have?"

Department Manager: "Great! We had a marvelous month. And say, you ought to see the appliances go!

"I rigged up a display of small stuff — mixers, sandwich toasters, waffle irons, coffee makers and the like.

"It wasn't a large display—only three little tables. But do you know—without any effort on our part those three little tables sold $8000 worth of appliances.

"Imagine Eight thousand dollars! . . . from three little tables! . . . in one month!

"Honestly, I wouldn't have believed it. The merchandise just simply sold itself".

P·G·and E·

PACIFIC GAS *and* ELECTRIC COMPANY

Owned · Operated · Managed by Californians

EW 112-1236

Lucy

1937

The Red Seal Year

THE ring of pounding hammers and the merry jingle of cash registers resound through the land as the building boom spreads. *BUT* some of the merriest tunes are being played on cash registers that have nothing to do with the electrical industry.

Many of the new homes are being poorly wired because nobody has told the owner about the importance of adequate wiring. Many of the homes being remodeled are not being properly modernized electrically for the same reason.

Electrical wiring does not present much dramatic appeal compared with the appeal of a beautifully landscaped garden, exquisite household furnishings, a colorful extra bathroom, or any of the other desirable things the home owner has to choose from when he is considering spending his household dollars.

If the electrical industry is to get anything above the absolute minimum of this dollar, the householder must understand that the comfort and convenience of excellent electrical service made possible by adequate wiring, is more desirable than any of these other things.

There's only one way he can get such understanding, and that is by the concerted effort of the electrical industry to promote better wiring.

We have distributed several thousand pieces of literature on wiring in response to requests in 1936, so we know there is tremendous latent public interest in our story of *Red Seal* wiring.

Sell *Red Seal* wiring for every new home built in 1937 and watch the electrical industry prosper.

Pacific Coast Electrical Bureau

447 Sutter Street, San Francisco

601 West 5th Street, Los Angeles